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ALTERNATIVE PRICING AND DELIVERY STRATEGIES FOR ALBERTA CATTLE FEEDERS

by

Bruce Gordon Viney ©

A thesis submitted to the Faculty of Graduate Studies And Research in partial fulfillment of the requirements for the degree of Master of Science

in

AGRICULTURAL ECONOMICS

DEPARTMENT OF RURAL ECONOMY

EDMONTON, ALBERTA

FALL 1995

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The undersigned certify that they have read, and recommended to the faculty of Graduate Studies and Research for acceptance, a thesis entitled ALTERNATIVE PRICING AND DELIVERY STRATEGIES FOR ALBERTA CATTLE FEEDERS submitted by BRUCE GORDON VINEY in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL ECONOMICS.

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Date July 18, 1995

Abstract

This study evaluates the risk and returns to cattle feeding in Alberta from the application of alternative marketing and pricing strategies. Feedlot finishing of 650 pound calves and 800 pound yearlings is modeled over the years from 1980 to 1993. The results of the study are based on the domestic and US marketing of live cattle using traditional cash marketing, futures contracts, put options, and forward production contracting systems. Use of the Western Domestic Feed Barley contract is also simulated.

The results showed that barley price changes produced relatively small return changes compared to feeder and fat cattle price changes. An important source of return risk was found to be basis risk. Production contracting strategies which eliminated basis risk were found to provide the best returns in a market based risk-return comparison. The use of put options did not add value to cattle feeding investments.

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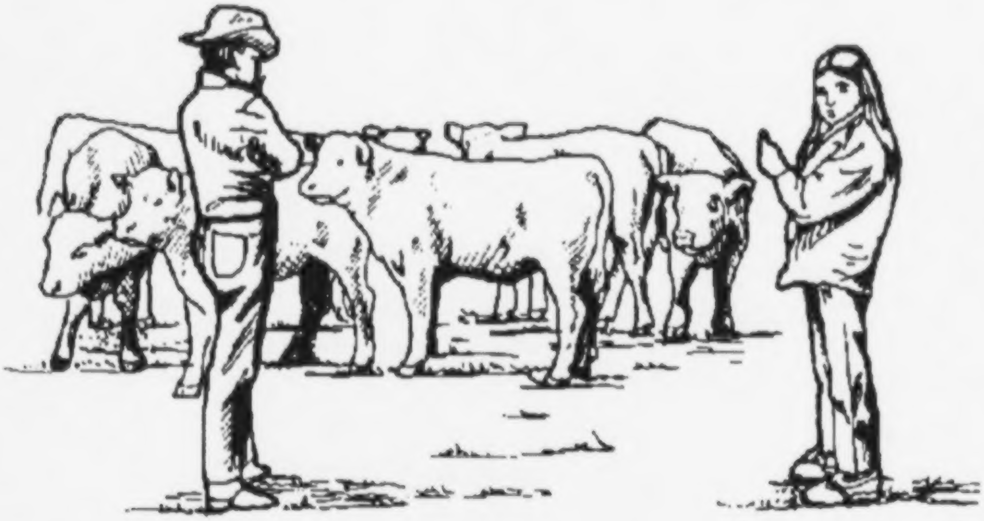

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CHAPTER 1. INTRODUCTION

The Alberta beef cattle industry is currently in the midst of transition to a more self sufficient and internationally oriented industry. As well, the Alberta feedlot and beef packing industries are currently in a stage of rapid expansion. To maintain and increase the levels of international trade, the National Tripartite Stabilization Plan (NTSP) and Alberta Crow Benefit Offset Program (CBOP) have been eliminated. Because of the loss of these income enhancing and risk reducing government programs, beef producers must adopt alternative risk management and profit maximizing strategies to maintain and improve the financial viability of their operations.

The loss of the NTSP as a risk management tool has posed a serious problem for Alberta cattle producers. Without the guaranteed margins that were present with NTSP, producers are susceptible to experiencing large negative returns which can seriously affect farm equity levels. This project evaluates and suggests alternate pricing and delivery strategies that cattle producers can use to minimize the potential for cattle feeding losses in the post NTSP time period.

Futures contracts, options on futures contracts and forward contracts are alternative marketing strategies that have become common among many progressive cattle feeders. The initiation of the Western Domestic Barley futures contract has also provided an input cost management instrument for cattle feeders. However, application of these alternatives has been greeted with skepticism by many smaller sized producers and agricultural lenders. It is important that all stakeholders understand the advantages and disadvantages of these tools so that producers can implement risk management strategies that are appropriate for their own operations and management styles.

Research has shown that hedging short-keep cattle in Alberta with a Chicago Mercantile Exchange (CME) live cattle contract can significantly reduce slaughter price risk (Unterschultz, 1991). It is important that forward contracts and options on futures contracts also be critically evaluated to determine their costs and benefits. An evaluation of marketing strategies using forward contracts, futures and options will allow cattle producers to make more informed management decisions in achieving their marketing goals. Evaluating the uses of the barley futures contracts will also assist cattle feeders in managing input costs.

1.1 Study Objectives

The primary objective of this study is to determine the effectiveness of forward contracts as risk management tools by using historical simulation techniques. This study will also formulate and evaluate other marketing strategies that use futures contracts and options on futures contracts with the cash marketing alternative as a base for comparison.

This project models the Alberta beef production and marketing systems with as much detail and realism as possible. To achieve this objective the study relies on producer input for the development of feasible cattle production, marketing and risk management strategies.

Another objective of this study is to apply historical Western Domestic Feed Barley (WDFB) futures prices to input price reduction strategies. The relative magnitude of barley costs in comparison with other inputs is also investigated.

1.2 Study Plan

Chapter 2 is an historical overview of the Alberta cattle feeding industry with an examination of the common production and marketing systems currently being used in Alberta. The common cash marketing, contracting and hedging systems are also discussed. The chapter also discusses the efficiency of futures markets as predictors of future cash market prices from a theoretical perspective. Chapter 2 then goes on to discuss the common risk measurement and comparison techniques which have been used by researchers in making market price predictions and in evaluating different investment and marketing alternatives.

Chapter 3 is discussion of the data which is used in the simulation analysis. The chapter also explains the conversion of observed data into the formats which are used in this study.

Chapter 4 is an explanation of the methodology used in the simulation models. The feed ration formulation and cattle feeding parameters are presented. Marketing parameters to both domestic and US packing plants are discussed. The chapter also outlines the basic formulas used in calculating the various model outputs.

Chapter 5 is a presentation and discussion of cattle feeding returns from marketing cattle to domestic and US packing plants. The chapter also examines the use of the live cattle futures contract in hedging and contracting simulations in comparison with a traditional cash marketing strategy. An examination of potential margin requirements with routine hedging is also presented.

Chapter 6 is an evaluation and discussion of the relative input components to cattle finishing. Strategies using the WDFB contracts for barley price risk reduction are discussed.

Chapter 7 is a study of the cattle feeding industry over the time period from 1987 to 1993. This section introduces the use of put options to the yearling simulation models. Cash marketing, and contracting cattle to US and Alberta packing plants are strategies which are evaluated in conjunction with the put options.

Chapter 8 presents the central conclusions extending from the various cattle feeding simulations. Implications for cattle producers are discussed and directions for future research are also proposed.

CHAPTER 2. BACKGROUND

The cattle industry in Alberta has become very intensified and competitive in the past several years. Income enhancing government programs including the National Tripartite Stabilization Plan and Crow Benefit Offset Program (CBOP) have contributed to a large increase in Alberta calf production and feedlot capacity.

2.1 Cattle Production Systems

Cattle production in Alberta can be broadly described in three separate stages: ranching or cow-calf, backgrounding or growing, and finishing. Cow-calf and finishing operations are often quite specialized while backgrounding is often a vertical extension of both feedlot and cow-calf operations. Recently, there has been a growing number backgrounding operations that specialize in wintering and pasturing cattle. Some enterprises have developed highly efficient, totally integrated systems where cattle are raised from conception to slaughter under the same ownership. In general, the traditional diversified family farm operations have given way to more efficient and specialized systems.

Cow-calf operations are typically located in areas where the soil and climate conditions are considered marginal for grain production. Most calves are born in the late winter or early spring and then placed on summer pasture while nursing. The calves are then weaned in the fall at weights from 350 to 750 pounds. Calves grown on specialized cow-calf operations are normally marketed immediately after weaning. In some cases, ranchers will chose to background calves until mid to late winter before marketing. Fall calving has also become popular with some producers as it generates light weight weaned calves in a season of higher demand.

The lighter end of spring born calves are normally backgrounded on a low energy feed ration for the winter before going back to pasture for increased frame growth. The heavier end of the spring calves are normally pushed to a high energy finishing ration in mid winter to provide a finished carcass for the spring markets. Calves weaned at 450 to 550 pounds are normally backgrounded until spring before being placed on a finishing ration for slaughter in the summer. Depending on market conditions, these mid-weight cattle can go to finish or go to summer pasture for further frame development.

Cattle finishing is a process that has responded well to economies of scale. Alberta feedlots have rapidly increased in size with several feedlots having one time capacities in excess of twenty thousand head. The general feeling in the industry is that the minimum efficient size of finishing operation is approximately ten thousand head. Although the large lots are very efficient cattle finishers, many of the larger sized feedlots have lost the capacity to cost effectively handle weaned calves. Because calves are very susceptible to severe disease problems, they require high levels of skilled labor after weaning. Lighter calves also require a ration that is high in roughage which is often difficult to purchase and transport in a large commercial feedlot setting. Smaller farm feedlot operations have been quite successful in reducing the calf morbidity and mortality as well as overall feeding costs.

Backgrounding is becoming a more specialized sector of the industry as some established feedlot owners cannot compete with the large feedlots on finishing cattle. Custom backgrounding of calves has become common as some large feedlots and marketing firms contract out the growing stage of production. However, this study focuses on the finishing phases of cattle feeding where cattle are typically marketed to slaughtering operations.

2.2 Marketing Systems

The Alberta beef industry is supplied by many firms offering traditional as well as innovative new marketing services. Most feeder cattle and calves are sold through conventional auction markets with some producers making private treaty and contractual arrangements. Fat cattle are often sold by sealed bids F.O.B. the feedlot, with some cattle sold on contract basis to both Alberta and US packing plants.

2.2.1 Domestic Cash Marketing

In the early years of the Alberta Cattle industry, producers sold their cattle to commission agents who traveled the countryside buying cattle to be sold at the railhead markets in Calgary and Edmonton. With the development of small auction markets throughout rural Alberta in the 1950s, farmers began to receive open competitive bids for both feeder and fat cattle. Farmers having full load lots could continue to deliver cattle directly to the Calgary and Edmonton stockyards, or make private treaty arrangements directly with the packing plants.

The network of rural auction markets has since contracted and become highly specialized in selling feeder cattle. It is not uncommon for one rural auction market to sell over 5000 head per day during peak seasons. Cattle are sorted into uniform groups, weighed, and then shown in the auction ring where they are sold to the highest bidder. Recently some auction markets have been successful in arranging 'pre-sort' sales which increase the market's capacity. Some auction markets have adopted video and satellite technology for selling uniform pens of cattle without the added stress and shrinkage of auction market transportation and handling. Computerized auction systems where cattle are sold to subscribers of a marketing service have also become popular with some producers.

Some ranching cooperatives have also been successful in organizing load lot auction sales in their local communities.

Fat cattle have traditionally been sold by private treaty or sealed bid on both live weight and rail grade terms. The sealed bid system requires packing plants to place offers with a feedlot for a specified lot of cattle at a specified time under the feedlot's selling terms. Some finished cattle are sold by auction over a computer network to subscribing packing plants while some feedlots sell cattle direct to one packing plant with the prices determined by various market price formulas.

2.2.2 Cattle Exporting

In response to the beef industry's consolidation in Alberta, large meat packing and processing firms have invested in plant construction and expansion. Although Alberta's beef industry infrastructure has improved, live cattle continue to be exported to the northwestern United States. This is confirmed by the continued operation of contracting agents securing supplies for the US plants. Producers report the participation of US packing plants in some of their weekly live cattle sales.

A recent increase in finished cattle exporting activity is due to increased Alberta supply as well as an increase in the typical Alberta cattle feeder's knowledge about the US cattle markets and the US grading system. Beginning in the early 1980s, Alberta cattle buyers began offering live cattle contracts to Alberta producers based on the Chicago Mercantile Exchange (CME) futures prices. These contracts specified the weights and grades of cattle to be delivered to US packing plants.

Cattle exported to the US must meet certain carcass characteristics to receive to the quoted or contracted price. Most cattle exports required the producer to guarantee the minimum carcass quality standards although some later exports have received farm-gate prices which are guaranteed by the US packer. These carcass characteristics are further discussed in Chapter 4.

2.3 Government Programs

Prior to 1986, Canadian and Alberta cattle producers received government subsidization through various ad-hoc Provincial and Federal schemes. After a period of negative profits, governments would often provide payments to producers to assist in stabilizing farm income. As well, some provinces would offer profit enhancing programs to their cattle industries to secure a larger share of the Canadian industry. These ad-hoc programs promoted the balkanization of the industry to where production was occurring in locations that were not necessarily the most efficient. The 'top loading' or direct subsidy nature of many of the ad-hoc programs was also a concern of US producers and trading counterparts. To address the top loading and balkanization concerns, the National Tripartite Stabilization Program (NTSP) was developed.

2.3.1 The National Tripartite Stabilization Program

In an effort to stem the increasing competition among provinces, the Federal and Provincial Governments initiated the NTSP in July 1986, with payments retroactive to April of 1986. Participation by the major cattle producing provinces insured that the previous top loading practices would cease, with the intended result of a more level and predictable playing field for all producers.

The NTSP was an insurance program funded equally by the Federal Government, the Provincial governments and the producers. Segments of the program included a finisher, backgrounder and cow-calf option. Of the three main options, the finishing option was the most widely used by Alberta producers.

The finishing option of the NTSP insured cattle finishers a guaranteed margin based on indexed national average cattle and input prices. Producer premiums paid into the program ranged from $6.60 to $8.10 per head for finishing cattle while payments from the program reached a maximum of $189.53 per head (Munro, 1993).

The level of risk reduction and income enhancement that the NTSP provided was quite large with positive cash flows going to most producers. With producers paying only one third of the premium cost, the subsidization provided to the Canadian industry was obvious. With threats of international trade action from the US Government, the NTSP was ended in December of 1993.

This study does not attempt to measure the effects of the NTSP and does not include NTSP payments in the return calculations. Although the price data used were actual market prices, it is important to recognize that the NTSP likely had an effect on the live cattle prices from 1986 to 1993. In months and quarters when large payments were apparent, cattle producers would either hold back or dump fat cattle causing local packers to respond accordingly with their bids. Exports to the United States also increased as the longer feeding period required by the American grading system allowed producers the opportunity to push cattle into the month if NTSP payments and US prices were favorable. It is also quite likely that the feeder cattle market was somewhat higher as farmers and cattle feeders did not include the possibility of large losses when making their cattle purchase decisions.

2.3.2 The Crow Benefit Offset Program

The Crow Benefit Offset Program (CBOP), known earlier as the Alberta Feedgrain Market Adjustment Program, was a program of the Alberta Government designed to promote the production and use of local feedgrains. With feedgrains not receiving the price enhancing export subsidies that other grains receive under the Western Grain Transportation Act, it was felt that Alberta producers and processors were at a competitive disadvantage.

The CBOP was a direct subsidy program which paid grain producers for each tonne of grain sold to registered end users. The per tonne payment was; $21.00 from September 1985 to June 1987, $13.00 to August 1989, and $10.00 to March 31 1994. The program ended in 1994 as the result of Provincial Government budget constraints and the general trend towards less industry subsidization.

Since this program was a direct subsidy and was widely used, the barley prices used in this study reflect the net cash price paid by cattle producers. Silage prices also reflect the subsidized opportunity cost of processing a field of barley for forage.

2.4 Risk

Webster's dictionary defines risk as the possibility of loss or injury. Returns to feeding cattle in Alberta are subject to two primary types of risk, production risk and cattle marketing risk. Production risk consists of un-predicted interest costs, feed conversions, feed costs, morbidity, and mortality. This study examines feed cost risk as represented by the unexpected change in barley costs. Marketing risk is represented by the variability of returns due to changes in cash market prices, futures market prices, and basis levels.

Due to capital constraints and lifestyle considerations, many farmers and cattle feeders have a limited ability to reduce overall return risk through diversification into additional assets. In general, farmers have been limited to on farm agricultural investments that provide a return to the owner's management and labor. Thus, with limited diversification opportunities, farmers have traditionally managed risk using commodity specific derivative instruments and government programs.

By using derivatives and government programs, farmers are attempting to change the distribution of possible returns to where negative returns are less likely. The distribution of returns are typically described by the mean and variance statistics. The mean is the average of a series of returns while the variance is a measure of the dispersion of returns around the mean. The variance is often described in terms of the 'standard deviation' statistic. Derivative instruments and government programs typically facilitate truncation of the lower part of the return distributions by establishing floor prices or minimum expected return levels. Instruments that truncate the lower part of the distribution typically come at the expense of reduced mean returns through the payment of premiums or taxes. Hedging with futures contracts can be useful in truncating the bottom of the distribution, however, the probability of large positive returns may also be reduced.

Firms without alternative investment instruments typically use risk management strategies based on safety-first criteria. With the safety-first criterion, producers make investment or production decisions based in the likelihood of adverse returns occurring. In cattle feeding, this concept can be represented by the number of pens with a given level of return or the minimum return that is likely to occur.

When the investor or manager has a choice between production and marketing strategies, stochastic dominance criteria can be used to rank the outcomes according to mean and variance of returns. Preferred strategies are chosen based on the investor's risk preferences and the relative mean and variance of returns. A special case of stochastic dominance evaluation is the expected value-variance model or E-V analysis. The E-V analysis uses stochastic dominance criteria to select the 'best' investment alternative subject to expected returns, variance of returns and risk preferences. The E-V analysis is more commonly used in evaluating production decisions although one form was used by Miller (1986) to evaluate forward contracting with respect grain yield uncertainties. The E-V analysis assumes that producers are risk averse and wish to minimize the variance of their returns. Thus, comparing two strategies with the same mean will result in the lower variance strategy being preferred. Strategies with high mean returns in relation to the return variance will be preferred by investors depending on individual risk preferences.

Once the investor or cattle feeder is allowed to include alternative investments in the investment portfolio, a new class of risk measures becomes available. These measures make use of market-based risk-return tradeoffs. The capital market line (CML) and the capital asset pricing model (CAPM) are two methods that are commonly used for comparing alternative investments. The slope of the capital market line represents the risk return trade-off that an efficient portfolio of assets provides. The efficient portfolio used in CML analysis is not a well diversified portfolio, thus, the mean-variance criteria used in the E-V analysis is also appropriate. With the CML comparison, the risk return tradeoffs from cattle feeding strategies can be compared to the risk return tradeoffs of other financial assets.

The CAPM is a popular tool for evaluating investment opportunities and alternative investments. The CAPM breaks risk down into two components; systematic and non-systematic risk. Systematic or market risk is the proportion of the portfolios variability which cannot be removed by diversification into other assets. For example: the Toronto Stock Exchange (TSE) 300 index is a diversified portfolio of assets which has a variance that is not reduced by the inclusion of additional assets (Daily,1993). Non-systematic risk or 'unique risk' is that portion of a portfolios risk which can be reduced with the inclusion of an additional asset. "For a reasonably well diversified portfolio, only market risk matters." (Brealey and Meyers, p151).

The CAPM values an asset by comparing the individual asset's variability with the market portfolio variability through the following derivation of the asset's β coefficient.

$$\beta = \frac{\text{cov}(X,M)}{\sigma_m^{\ 2}} \tag{1}$$

In this calculation, cov(X,M) is the covariance of asset X's return and the return from the market portfolio, M. The $\sigma^2{}_m$ term is variance of the market portfolio, thus, β is a measure of asset X's systematic risk. The return from asset X is then located on the CAPM security market line which is defined as:

$$E(r_X) = r_f + \beta_X(r_M - r_f) \tag{2}$$

where r_f is the risk free rate of return and r_m is the market return. Thus $(r_m\text{-}r_f)$ is a measure of the market portfolios risk premium and $E(r_X)$ is a measure of asset X's required rate of return given its correlation with the market. Thus, an asset having a β equal to 1 would have no unique risk and would not demand a risk premium, or higher expected return than that offered by the market portfolio. Previous research by Coles (1989) suggests that Alberta feeder cattle investments exhibit a β equal to 0.64 using the TSE 300 as the market portfolio. One application of the CAPM analysis to cattle feeding is in the promotion of feeder cattle as an alternative investment for inclusion commercial investment portfolios. However, this is not the primary focus of this project. Thus, this project focuses on the safety first, E-V analysis and CML comparisons for alternative marketing strategy evaluation.

With the E-V analysis, the variance of returns can be represented by both the standard deviation of returns and root mean square error measurements. Since cattle feeding risks are generally considered short term risks, they can be measured using the mean square error measurement. This measure is widely accepted and was used by Unterschultz(1993), Daily(1993), Elam(1992) and Coles(1989). The mean square error criterion is commonly defined as:

(3)
$$MSE = \sum_{i=1}^{pens} \frac{\left(P_i - A_i\right)^2}{n}$$

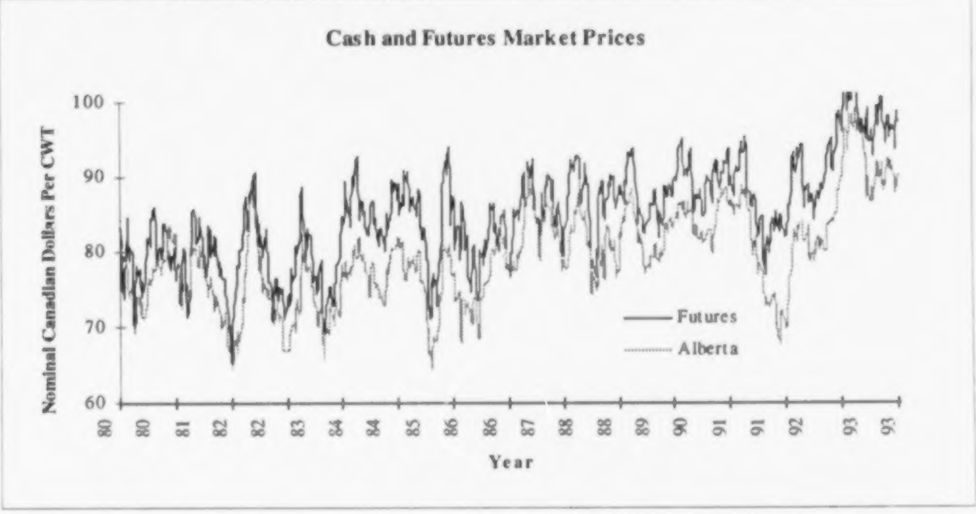
where P and A are the predicted and actual cash prices respectively. The MSE is often transformed into the root mean square error (RMSE) by taking the square root of the above equation. The RMSE gives a measurement which resembles the common standard deviation measure and is in the units of the price or value being analyzed.

2.4.1 Price Risk

Using the MSE measurement, price risk on cattle is the amount by which the observed price differs from the expected price level. Unterschultz (1991) concluded that slaughter price risk was the major source of risk in finishing short-keep steers. The relative levels of risk are determined statistically by comparing the actual ending price levels with the projected levels. When hedging strategies are used, the change in the live cattle futures contract price from its expected level is the source of price risk.

Price risk is associated with the volatility of both cash and futures market prices. The volatility, or variance is often described in terms of the the standard deviation or the square root of the average of squared deviations from the mean price level. Figure 1 shows the price performance of both the nearby live cattle futures contracts and the Alberta direct to packer slaughter prices measured in nominal Canadian dollars. Of note in the figure is the rapid price changes which can result in both large profits and losses in cattle feeding.

Figure 1. Live Cattle and Futures Prices



2.4.2 Live Cattle Basis Risk

The live cattle basis is the difference between the futures market price and the Alberta cash price on a specific day at a specific location. In Alberta, the basis is often defined as: Basis = (US $ Futures Price * Exchange Rate) - Alberta Price. This calculation usually results in an Alberta basis number which is greater than zero. Basis can also be expressed as a number that is generally less than zero and calculated as Cash - (US $ Futures Price * Exchange Rate). Both basis representations are used by industry participants, however, this study will present basis as a generally negative number as calculated in the second equation.

Terms describing the relative magnitude of the basis and changes in the basis are 'wide', 'narrow' and 'positive'. A wide basis occurs when the absolute value of the basis is at a relatively high level. A narrow basis is when the absolute value of the basis relatively small. A situation when the Alberta cash price is higher than the exchange rate adjusted futures price is generally referred to as a 'positive' basis. Table 19 in Chapter 7 shows these average monthly basis levels and relative variation of the average monthly levels expressed as standard error of basis over the same time period.

Basis risk is the variability of the difference between the cash price and the CME futures price at the time of sale. As shown in Figure 1, the basis has shown instances of very rapid change over the time period from 1980 to 1993. Previous research has identified basis risk as a potential source of net return risk. Carter and Loyns (1985) found changes in the basis level for Canadian cattle to be a severe detriment to hedging effectiveness. In contrast to storable commodities, the live cattle basis is highly variable over time as the final product changes form. Some researchers (Price et al. 1979) have assumed that basis variations are entirely random over time. In contrast, Leuthold et al. (1984) suggests both a systematic and an unsystematic component to basis changes which implies that " information could permit identification of high within-contract basis risk and lead to appropriate marketing strategies". Recent research using actual US transaction data suggests that "Of the unexplained variation in long-run profit or risk, 57% was due to basis risk, 20 percent was due to production risk, and [only] 14% was due to price level risk." (Koontz and Trapp, 1995)

It should be noted, however, that the basis levels in Table 1 were calculated using the average weekly Alberta steer price. The basis levels that were observed by Koontz and Trapp and the basis levels that the cattle feeder actually experiences is the difference between the price of the individual load or pen of cattle being sold and the futures price. The actual observed price may in fact be somewhat different than the average Alberta price due to changes in the expected carcass grade, yield and weight discounts from the expected discounts when the feeder cattle were purchased. As well, within the transaction week, price variation from the average may also affect basis risk. Thus, the basis variability as shown in Table 1 and the magnitude of basis levels in the simulation results are likely understated.

Table 1. Monthly Average Basis Performance

Month	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec	Ave
Mean	-5.45	-5.32	-3.78	-3.05	-3.33	-6.15	-7.41	-7.28	-6.99	-5.39	-4.76	-5.95	-5.38
St. Dev.	6.99	7.52	7.47	6.37	5.76	5.03	4.83	5.87	6.07	5.92	6.51	7.3	6.30

The statistics in Table 1 were calculated using the basis on the third Wednesday of each month over the time period of this study. Of importance to the basis risk is the high degree of historical variability shown by the standard deviation. Seasonal variations in basis are also evident in this table, however, a more detailed discussion of basis patterns will follow in later chapters.

2.4.3 Exchange Rate Risk

Exchange rate risk is included in basis risk through the conversion of the US dollar futures price (Caldwell,1982). Unterschultz (1991) concluded that "risk drops marginally when exchange rate risk on the forecast price is removed. With the Canadian cattle market following the US cash market fairly closely (Figure 1), changes in the Canada-US exchange rate will affect the actual selling price of the animals, however, the exact relationship between changes in the exchange rates and changes in the Alberta cash price is uncertain. However, there is little doubt that changes in the Canadian dollar value affect short run changes in cattle feeding profitability.

2.4.4 Margin Call Risk

Margin call risk is another form of risk that causes concern among cattle feeders and their lending institutions. As trading accounts are marked to market at the end of each day, hedgers are often required to deposit large amounts of cash with a brokerage firm. With repeated margin calls, a hedger's liquidity constraint can result in the removal of the hedge at an inopportune time. Using weekly futures price data, Munro (1993), found that margin requirements could reach as high as 30.1 percent of the contract value. The magnitude of potential margin calls with routine hedging strategies is presented in Chapter 5.

2.4.5 Input Price Risk

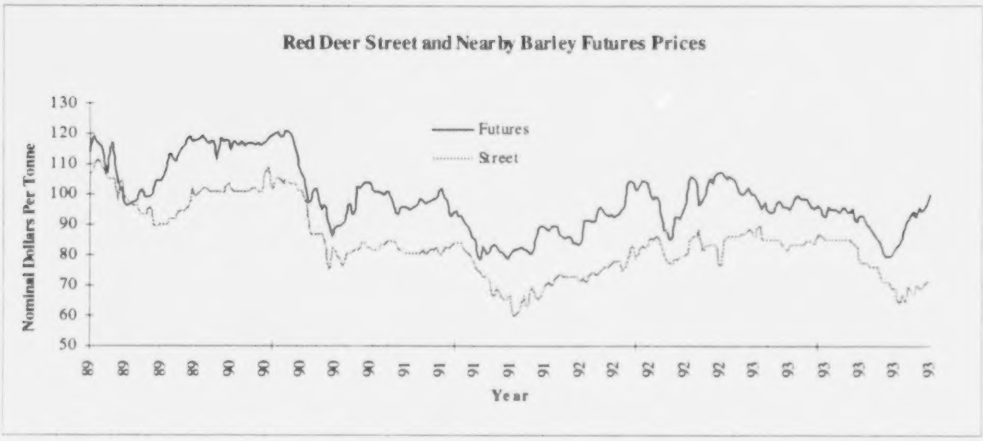
Input price risk primarily consists of unpredictable changes in barley, silage, and supplement costs to the cattle feeder or cattle owner. Supplement price risk is generally not believed to be a major cause of production risk, however, rapid changes in canola and soybean prices can have an impact in supplement prices.

The primary source of input price risk is barley price risk. Unexpected changes in the barley prices can affect profitability. Caldwell et al (1982) found that hedging Alberta barley costs with the CME corn futures contract increased cattle returns by 2.03 dollars per head. The relative magnitude of Alberta barley price risk will be discussed in Chapter 6. Since many cattle feeders are also grain and barley silage producers, barley price risk extends beyond the cattle feeding enterprise. Some small and medium sized cattle feeding operations convert the returns from cattle feeding into returns per unit of barley and barley silage used. However, this study will focus of the cattle feeding enterprise as a separate entity which calculates returns based on the observed market prices of barley during the feeding period.

2.4.6 Barley Basis Risk

As with cattle basis, the barley basis is the difference between the futures price and the cash price on a given day. In this study, the relevant basis is the difference between the WDFB contract and the barley street price at the feedlot location and is normally calculated as: cash price - futures price. Caldwell et al (1982) found the basis from the Chicago corn contract to "not show any abnormal variation". The barley basis level contains the appropriate transportation and transaction cost discounts for specific production and consumption locations. Figure 2 shows the weekly nearby WDFB prices and cash price levels at Red Deer Alberta from the beginning of the WDFB contract to the end of 1993.

Figure 2. Red Deer Barley Basis



When examining the difference between the two price levels it is apparent that the basis is somewhat variable over time. However, the relative variability in the basis does not appear to be as high as with the live cattle. The average monthly Red Deer barley basis levels and standard deviation of basis levels are shown in Table 2.

Table 2. Average Red Deer Barley Basis

Month	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Sep	Oct	Nov	Dec	Ave
Mean	13.10	14.96	16.00	16.47	13.89	11.13	8.52	10.12	12.58	15.7	21.53	18.99	14.33
St. Dev.	2.70	3.26	2.53	2.47	5.21	5.31	3.62	6.04	5.69	3.89	3.40	4.68	5.59

The average basis level was 14.33 dollars per tonne while the standard deviation was 5.99 dollars per tonne over the whole time period. The relative variability of the basis is somewhat smaller than the live cattle basis variability as described by the means and standard deviations or a coefficient of variation.

Also of note in Table 2 is the seasonal nature of the basis. The periods of wide basis are normally consistent with periods of relatively high barley supplies in relation to the expected future price. The narrow July basis of 8.52 dollars per tonne is consistent with seasonal production and delivery patterns of Alberta grain farmers. A further discussion of the basis variability will follow in Chapter 6 while the next section discusses some of the risk management systems that are available.

2.5 Risk Management Systems

Alberta producers have historically had three formal market based risk management tools available to them. The primary source of risk reduction has been in the form of both ad-hoc and permanent government programs. Freeze et al (1990) found the NTSP to produce significantly higher net returns with reduced risk. With the end of the NTSP for beef cattle at the end of 1993, cattle contracting and futures market hedging have become the primary price risk management tools. The introduction of the Western Domestic Barley Futures (WDFB) contract in 1989 has also provided a tool for input price risk reduction. The following sections provide some of the definitions and operational details of these tools.

2.5.1 Forward Contracts For Cattle

Forward contracts for live cattle allow cattle buyers and sellers to lock in a price for the delivery of cattle in future months. "A forward contract is a legal, binding commitment that prices a pre-specified product at a certain time, to be delivered to a specified place." (Ab. Ag.,1993) Early slaughter cattle contracts were made primarily with US packing plants while recently, Alberta packing plants have offered contracts to producers in order to secure a portion of their cattle requirements.

Slaughter cattle contracts typically have three primary components: the CME futures price, the guaranteed 'contract basis', and the cattle quality and delivery specifications. Most Alberta contracts also include a set value for the Canadian - US exchange rate. Some contracts which are commonly referred to as 'basis contracts' allow the producer to set the basis while remaining speculative on the CME futures price level and the exchange rate with the option of pricing the cattle at any time before delivery.

The CME futures price is the underlying price for the contract and moves up or down, depending on expected supply and demand conditions at the time of delivery. Contract basis levels also tend to change with supply and demand. Packers expecting a large supply of cattle on the cash market at the delivery date will tend to offer a wider basis, however, in some cases it is possible to have a positive basis. The contract basis level also contains discounts or premiums for the type of cattle being delivered on the contract. Heifers typically receive a wider basis than steers while dairy types receive large discounts from the futures price.

Fat cattle sold under contract are normally required to produce a certain amount of a specified quality beef. Both US and Alberta packing plants require that cattle produce carcasses with a minimum dressing percentage and yield grade, and be within certain weight ranges. Feeder cattle are sold on live weight terms with cattle required to be of specific frame size, type and flesh cover. Live feeder cattle prices are adjusted on a sliding scale if the actual weight differs from the quoted weight.

Forward contracts for finished cattle differ from futures market contracts in that the contract specifications are not universal. All of the four packing plants observed in this study offer unique contract specifications which differ from the CME cattle contract specifications. The typical specifications for the observed plants are as follows:

Lakeside Packers (Brooks Ab.)
Minimum weight per head - 600 pounds
Maximum weight per head - 800 pounds
Hot Yield - 59.5%
Grades - Canada A, AA, AAA only
Minimum allowable Yield Grades - 50% Y1, 40%,Y2, 10% Y3

Cargil Foods (High River Ab.)
Minimum weight per head - 600 pounds
Maximum weight per head - 800 pounds
Hot Yield - 59.5%
Grades - Canada A, AA, AAA only
Minimum allowable Yield Grades - 50% Y1, 40%,Y2, 10% Y3

IBP (Pasco Wa.)
Dressed Yield - 63%
Weight range; steers 600-900 pounds, heifers 550-850 pounds
Quality grade - 70% USDA Choice, balance top good
Yield Grade - USDA Y3 or better, 0% Y4

Monforts (Greeley Co.)
Dressed Yield - 63%
Weight range; steers 550-900 pounds, heifers 550-900 pounds
Quality grade - Steers 70% USDA Choice, balance top good
-Heifers 65% USDA Choice, balance top good
Yield Grade - USDA Y3 or better, 5% Y4s allowable

The above specifications are typical of the respective packing plants, however, there can be significant changes negotiated by each individual producer depending on the producer's production history and negotiation skills. Producers with a good record of production and consistent supply can often negotiate a slightly better basis without the normally required carcass specifications.

Forward contracts are true price risk reduction tools as the final price is guaranteed, assuming the carcasses are of the expected quality. In contrast with futures contracts, forward contracts are not easy to liquidate prior to expiry. With forward contracts, the packers accept the basis, however, actually delivery of the specified quantity of cattle must be made to the packer.

By transferring the basis risk to the packing plants through contracts, Elam (1992), found the net price to the feeder to be significantly lower in his study of Texas cattle feeding. He suggested that the returns on steers and heifers were 0.28 - 0.59 dollars per hundredweight and 0.86 - 1.64 dollars per hundredweight lower than returns from futures market hedging. Elam also reported a 10.00 dollar per head advance payment to producers upon signing the contract, however, there is no evidence of this practice in Alberta. Although he found some evidence of reduced prices, the reduced returns for steers are likely not important to cattle feeders, considering that the basis risk and cost of futures market margin calls is eliminated.

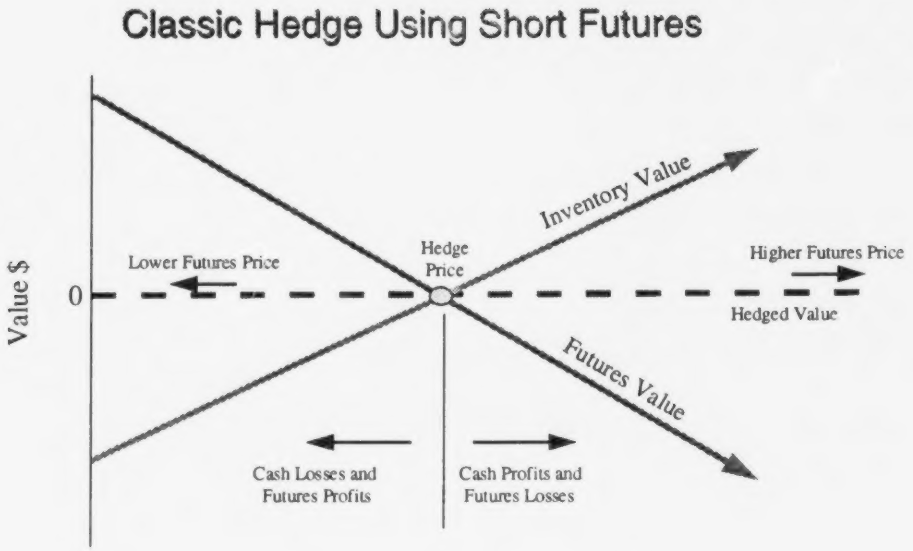
In contrast to the Elam paper, this study does not assume that contracts are held for four months. Evidence from Alberta producers and agents suggests that a significant number of cattle are contracted as far out as 10 months using deferred pricing programs. There is also evidence that the basis offered on contracts has seasonal patterns which can be exploited by producers. The next section looks at futures contracts where the producer accepts the basis risk.

2.5.2. Hedging With Live Cattle Futures

"A futures contract is a legally binding agreement between a buyer and a seller to exchange a commodity or instrument (or its cash value) later at a particular price, quantity, quality, location, and time." (Ab. Ag, 1991) The contract does not necessarily imply that execution of the contract will take place as the contract can be sold or bought back to offset the original position. In cases where the contract is not offset, cattle or the asset can be physically delivered. Traditionally only about two percent of contracts are actually fulfilled at maturity. However, the delivery mechanism facilitates the conversion of cash and futures prices at the maturity of the futures contract.

Futures market hedging requires the cattle producer to sell (go short) an appropriate number of CME live cattle futures contracts. The reverse, or offsetting, transaction is normally made at the time the live cattle are sold. It is hoped that profits or losses from the producer's short position in the futures market offsets the profits or losses in the live cattle market, thus, the positions will exhibit perfect negative correlation and the portfolio will be riskless in terms of unique or diversifiable risk. A diagram of the classic hedge value is shown in Figure 3.

Figure 3. Classic Hedge Example


Classic Hedge Using Short Futures
Value $
0
Lower Futures Price
Hedge Price
Inventory Value
Higher Futures Price
Hedged Value
Futures Value
Cash Losses and Futures Profits
Cash Profits and Futures Losses

With the classic hedge shown in Figure 3, the net returns are equal to zero as represented by the hedged value line. When the futures market price rises above the hedged price and the futures value drops below the hedge value, there will be losses in the futures position. These losses will be offset by an increase in the value of the live cattle inventory investment. When futures price goes down from the initial hedge level, the live cattle will loses money and the short futures position will provide positive returns. Ideally, futures market profits will offset cash market losses and visa versa. However, this results depends on having perfect negative correlation between cash market prices and the futures market price; a condition which is not present in the Alberta cattle market as shown by Figure 1. By taking a short hedge, the hedger accepts basis risk in return for eliminating the actual price level risk.

The effectiveness of hedging Canadian cattle on the CME has been the subject of research over the past several years. Carter and Loyns (1985) concluded that hedging often reduced returns and increased price risk for the lots of cattle in their case study for the period from 1972 to 1981. This result was attributed to the variability of the basis over the study period. Unterschultz (1991) concluded that Alberta basis is less variable now than it was ten years ago. He also concluded that a simple routine hedge significantly reduced risk while reducing returns only slightly. Selective hedging of cattle was found to reduce risk while increasing net returns.

The key factor affecting hedging effectiveness and net returns is the behavior of the basis from the time the positions are taken until the time the positions are offset. As described in section 2.3.2, the Alberta live cattle basis has been highly variable, thus, futures market hedges may not exhibit perfectly negative return correlation. This situation is concern to hedgers when trading accounts are 'marked-to-market' at the end of each day. With marking to market, a hedger is obligated to offset futures market losses in the trading account at the end of each day by fulfilling the brokerage firm margin requirements. The required cash outlays may be a limitation to hedgers, especially when the gains in the cash market cattle may not offset the day's futures market losses. The discussion in the next section looks at live cattle options where the producer keeps the basis risk but can choose not to be exposed to potential hedging margin requirements.

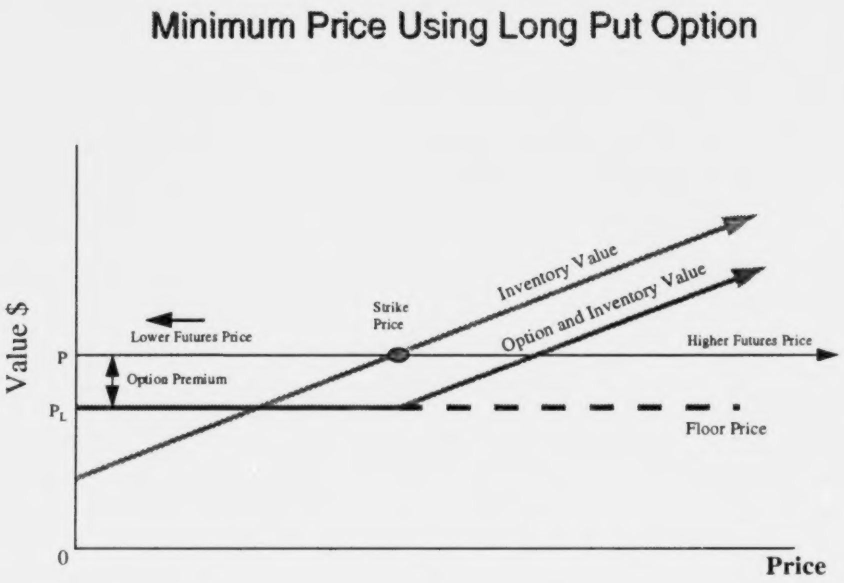
2.5.3 Live Cattle Options

An option on the live cattle futures contract gives the holder the right, but not the obligation, to take a position in the underlying futures contract. A put option gives the long position holder the right to take a short position in the underlying futures contract. A long call option holder has the right to take a long position in the futures contract at the specified strike price. In theory, cattle hedgers can set a floor price on their cattle by paying a market derived premium for a put option having the desired floor or strike price. Put options allow producers to minimize the downside risk while capturing all of the potential upside profits. As well as capturing the market's upside potential, long put holders are not faced with the management of brokerage firm margin accounts.

CME put options can be re-sold or exercised when the cattle are ready to be sold on the cash market. If the option does not have any chance of being in the money at any time before maturity, it can be allowed to expire worthless. At the end of the hedge there will often be some time value remaining in the option that can be sold to other investors. The proposed 'Canadianized' over-the-counter (OTC) options are put options that use a cash settlement procedure rather than the actual transfer of a short futures position in the event that the option is in the money.

Combinations of cash commodities, futures contracts and options contracts can be used for designing investment and risk management strategies with various payoff and profit scenarios. Although there are a multitude of option trading strategies, this paper will only simulate the simple hedge or minimum price strategy. The simple hedge involves the purchase of a put option (long put) at the desired strike price. The minimum price strategy is illustrated in Figure 4.

Figure 4. Minimum Price With Long Put Options


Minimum Price Using Long Put Option
Value $
P
P_L
0
Price
Lower Futures Price
Option Premium
Strike Price
Inventory Value
Option and Inventory Value
Higher Futures Price
Floor Price

With the strong assumption that the value of the option and the cash market value of the inventory will exhibit perfect negative correlation, a minimum price is observed when the futures price is below the option strike price. At these prices, positive option payoffs occur. When the option payoffs are combined with a declining cattle inventory value, a minimum or 'floor price' value is observed. At low futures prices where the 'Inventory Value' line is below the 'Options and Inventory' line, use of the put option will have positive value to the hedger. At futures prices above the strike price, negative option profits are equal to the premium amount. Thus, to the right of the strike price in Figure 4, the 'Option and Inventory Value' line is below the 'Inventory Value' line by the amount of the option premium.

Although profit patterns received from option trading strategies can be designed to coincide with common hedging objectives, perfect hedges are not always easy to achieve due to imperfect negative option and inventory value correlation. In the event of a price decline, the positive profits from the put options may not exactly offset the negative change in value of the cash commodity. As was the case with the classic hedge, the minimum price put option strategy also leaves the hedger exposed to basis risk.

When using futures contracts for hedging, the relative variability in the basis is an indication of potential hedging effectiveness. Typically, optimal hedge ratios are calculated to minimize the variance of returns from a portfolio of futures contracts, and the underlying commodity. Thus, the variability of basis influences the number of contracts required for an optimal hedge. When the futures and cash prices do not move together perfectly, the optimal hedge ratio is not one futures contract per unit of commodity.

Optimal commodity hedges using options are often more difficult to achieve than when using futures contracts alone. This is due to the way in which the value of the option changes with respect to changes in the commodity price. Along with the variability in basis, is a less than perfect correlation between the price of an option and the futures market price. That is, when the futures price changes, the cash commodity price changes at one rate while the value of the option changes at another rate. Thus, the optimal number of options contracts to hedge 40000 pounds of live cattle will likely be different from the optimal the number of futures contracts. Although it is important to recognize that optimal hedge ratios may be used to minimize total return risk, the simulations in this study will use one-to-one hedge ratios for comparison purposes.

Previous research has provided mixed results regarding the usefulness of agricultural options for hedging. In their expected utility model which incorporated price and basis uncertainty, Lapan et al (1991) concluded that "when futures prices and options premiums are perceived as unbiased, options are redundant hedging instruments." Hauser and Eales (1987) conclude: "hedging with options is not a free lunch. Regardless of the strategy, as return increases, risk increases." In their hog marketing simulation, Adam et al (1990) concluded that "a futures hedge for a (risk averse producer) and a futures hedge combined with buying a put and selling a call (for a less risk averse producer) perform well." A common message through the literature is that options are expensive hedging instruments. However, using riskless hedging simulations to evaluate alternative pricing models, Hauser and Liu (1989) concluded: "in general, inefficiency within the live-cattle options was not indicated". Thus, it is reasonably safe to say that large arbitrage opportunities have been bid out of the options market and producers are not likely to see future reductions in options premiums given historical price volatility patterns.

Although it appears that options may be expensive instruments, producers and Government officials are attracted to the floor prices that put options can potentially provide. Thus, the live cattle put options will be examined more closely in Chapter 7. The next section of this report discusses the input side of cattle feeding returns.

2.5.4 Western Domestic Barley Futures

The Western Domestic Feed Barley futures (WDFB) contract is a relatively new futures contract for Alberta and western Canadian barley production which began trading on May 24, 1989 at the Winnipeg Commodity Exchange (WCE). The WDFB contract conforms to the definition of a futures contract as stated in section 2.5.2. Before the introduction of the WDFB contract, the Winnipeg barley futures contract was the primary futures market hedging instrument for Alberta barley. It was felt that the Winnipeg contract with its Thunder Bay delivery point did not accurately reflect supply and demand conditions for feed barley in Alberta. This new contract was designed to more accurately reflect Alberta barley producer and consumer needs by incorporating flexible delivery alternatives for contract users.

The WDFB contract is for the delivery of 20 tonnes of barley to Lethbridge Alberta in the delivery months of February, May, August and November. Contract price changes occur in increments of 10 cents per tonne with maximum daily movements of 5.00 dollars per tonne. In the event that two of the three nearest contract months close at the 5 dollar limit up or down on two consecutive days, the limit is increased to 1.5 times the original limit. If two of the three nearest contracts continue to increase by the new limit, the limit is increased to twice the original 5 dollar limit on the fifth day. The barley must have a minimum density of 48 pounds per bushel with maximum moisture and dockage contents of 14.4 percent and 2.0 percent respectively. Delivery is based 'on truck' at Lethbridge.

Although the contract is for the 'delivery' of barley to Lethbridge, the futures contract is often used like the live cattle futures contract where open positions are offset prior to the delivery month. However, in the event that a futures position is open on the last day of trading or 'conversion day', flexible delivery mechanisms can be used. To accomplish the easy conversion of futures positions to cash positions, the Western Grain Clearance Association (WGCA) was set up. The WGCA coordinates the delivery and receipt of outstanding positions at the end of contract trading with the assistance of the Alberta Grain Commission. Because a large amount of barley production typically occurs in northern regions of Alberta while a large amount of cattle feeding occurs in southern regions, the flow of barley is typically north to south. The WGCA is mandated to minimize the transportation costs from the producers yard to consuming operation. Farmers and end users have frequently used the delivery mechanism to secure and make deliveries of the actual grain.

Because of the large number of deliveries on the contract, the WDFB adopted new delivery procedures in early 1995. These new procedures make the physical delivery of grain more difficult by requiring the barley buyers to post a letter of credit for 1.5 times the value of the barley to be purchased. Because the procedures are very new, only the previous delivery mechanisms will be discussed in this report.

With the previous delivery mechanism, the WDFB contract delivery was specified as 'on truck' at Lethbridge. Efficiencies were gained by by-passing the traditional elevation system. Consumers or feedlots which located south of Lethbridge could have the barley delivered to the farm gate by paying additional trucking fees from Lethbridge. Feedlots to the north of Lethbridge could often receive barley at a lower cost by paying the transportation rates from the selling location to the buyer's location. For Example: Say that a farmer at Innisfail had a short WDFB position while there was an open long position located at Olds. If the WGCA decided that the Innisfail farmer's grain could be delivered to Olds, the farmer would load the grain onto a truck and receive the closing price less the specified $14.90 freight rate and the industry standard one percent dockage. The long position at Olds would pay the producer the final settlement price less the 14.90 transportation costs from Innisfail to Lethbridge less the standard one percent dockage. The buyer at Olds then accepts responsibility for the trucking costs from Innisfail to Olds.

The WDFB contracts are used by cattle feeders primarily as an input hedging instrument for both short run and long run feed supplies. Cattle feeders believing in a long term price increase may go long one or several contracts to insure a relatively cheap barley supply for later time periods. If the cattle feeder is correct and the price of barley rises, the cattle feeder will have gained a cost advantage over competing feedlots not using the contract, thus, the feedlots will have higher expected returns when feeder cattle prices become adjusted with the higher feed costs. As with live cattle hedges, the timing of hedges and number of contracts traded will have an impact on profitability and may or may not reduce net return variability.

Short term barley hedges are used by cattle feeders and cattle owners to lock in production costs within a feeding period. One short-run strategy is for a large cattle feeder to go long the futures at the beginning of the feeding period and then offset portions of the position as the cattle approach market weight. Changes in cash barley prices will be offset by changes in the futures assuming that the basis is constant. Thus customers or cattle owners are assured that the barley costs with are relatively close to the costs at the start of the feeding period. This is the primary strategy which will be evaluated in Chapter 6. The discussion in the next section focuses on futures market efficiency arguments and measurements.

2.6 Futures Market Pricing

At the root of many discussions regarding the effectiveness of futures markets for the hedging of cattle is futures market bias and efficiency. Producers may not feel confident in using futures contracts, options and forward contracts as risk management tools if there is an actual or perceived bias in the futures market prices. Although futures market efficiency is the subject of considerable research (Garcia and Leuthold, 1988), the actual debate is not directly relevant to this study. However, it is important to recognize the concept of efficient markets and the pricing information which they provide to producers and hedgers. This section briefly examines the futures market price information and alternative pricing systems.

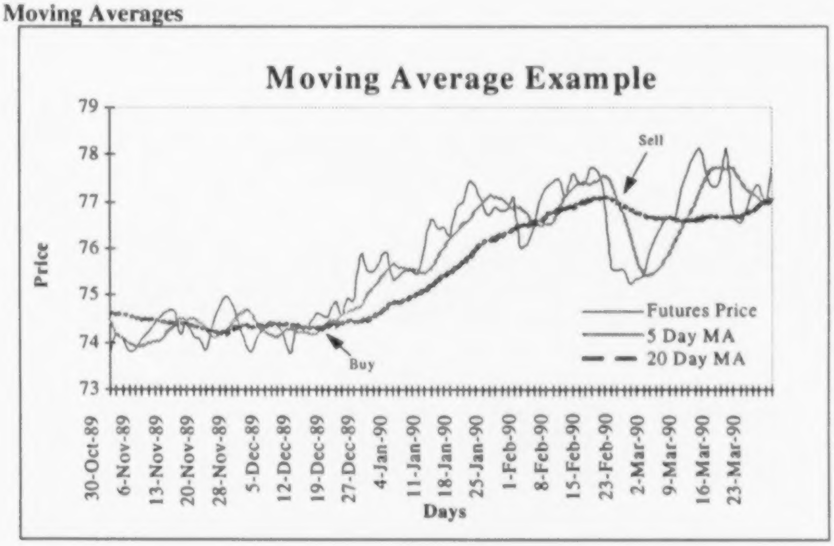
An efficient market is commonly thought of as a market where all of the relevant information is cheaply available to investors and "that all relevant and ascertainable information is already reflected in the security prices" (Brealey and Meyers, p.314). Although this notion does not imply perfect forecasting ability, it does imply that the futures price of the asset is the best available prediction of the discounted future cash flows from the asset. Thus, from a net present value perspective, futures market price forecasts are not biased. Efficient markets also imply that the volatility of an asset price is "caused solely by the random arrival of new information". (Hull, p244) Since cattle supply and demand information is widely available and relatively cheap, the cattle futures market price is believed to be an efficient and unbiased price predictor. The analysis in Chapter 6 examines potential futures market bias in terms of dollars per head and average annual returns from routinely taking a futures contract position that is opposite to the classic hedge position.

From an efficient market point of view, futures markets contain all of the publicly available information and profit opportunities are not widely available due to arbitrage trading. However, there is school of thought which suggests that "the technical dimension is useful in guiding the timing of actions in the markets as the supply demand balance is being sought via price discovery processes." (Purcell, p.59) The discussion in this section does not attempt to explain all of the various technical indicators that investors and hedgers use, however, an introduction to many of the technical signals can be found in Purcell, (1991). The point of this discussion is to recognize that there may be technical systems that can be used by cattle feeders to improve cattle feeding risk and returns. The technical analysis used in this study's simulations is limited to a simple system of two moving averages.

Typical technical indicators include things such as trend lines, moving averages, resistance and support planes, gaps, corrections, open interest information and relative strength indices (RSI). Dunlap and Franzmann (1986) found positive results from using moving averages and RSI indicators on weekly live cattle prices. Shupp and Whitehead (1986) also found benefits in using technical signals for cattle hedging. Although the listed technical indicators may be important to hedging decisions, this study only examines the combined use of 20 day and 5 day moving averages. "Moving averages in some form or type of applications are used by a significant percentage of commodity traders."(Purcell, p.191)

Moving averages are trend following indicators that can provide information to the trader on changes in commodity chart price patterns. The use of two or more moving averages of different lengths can provide buy and sell signals for traders. In a trending market the shorter moving average will lead the longer moving averages. With a change in the price trend, the shorter moving average will change direction more quickly and move across the longer moving average. The crossing of the moving averages generally indicates a change in market trend and potential buy or sell signal. Figure 11 is an example of 5 and 20 day moving averages plotted against a futures market price series that was chosen at random from this study's data set.

Figure 5. Moving Averages



The 5 and 20 day moving averages shown in Figure 5 are for the April 1990 live cattle futures contract daily closing prices from October 30, 1989 to March 27, 1990. The figure shows that while the market was in an up-trend from December of 1989 to January of 1990, the 5 day moving average was above the 20 day average. The crossing of the 5 day moving average to below the 20 day moving average in February indicated that the market had changed into a short downward trend. This crossing could potentially be a signal for hedgers to short the futures market or lock in the price on a pen of cattle.

The responsiveness of moving averages is directly related to the respective lengths of the moving averages. As shown in Figure 5, the February crossing of the 5 day moving average to below the 20 day moving average did not occur until the market had dropped approximately 1.5 dollars per hundred weight. Shorter moving averages would be more responsive to price changes, however, there would be a lot more trading signals generated. Although the 5 and 20 day moving averages do not respond rapidly to price trend changes, they do give an indication of general price trends. Thus, these two averages are used in one simulation model later in this report.

2.7 Summary

This chapter has reviewed some of the historical production and marketing systems that Alberta cattle producers have used in the past. It was found that Government programs had an effect on historical cattle feeding returns and risks. Thus, with the loss of the NTSP, alternative risk reduction tools will be increasingly important to many cattle producers.

Based on the classic hedge and put option examples, risk management strategies that use futures and options appear to have the ability to create minimum or 'floor prices'. However, the related issue of live cattle basis risk was apparent throughout the literature. The pricing and delivery structure of forward contracts for cattle should limit this exposure to basis risk. The WDFB futures may also contribute to decreased return risk by the hedging of barley prices. Production and marketing strategies using these tools may be preferred by producers and investors depending on the individual's risk preferences. Given the alternative marketing choices, the E-V and market based comparisons appear to be an acceptable method for strategy comparison.

Theory suggests that futures markets are relatively efficient and can be used in the prediction of future cash market prices. There is also evidence that technical trading or hedging decision rules can improve hedging and cattle pricing decisions. Realizing that there are many combined production, marketing, hedging and pricing strategies available to producers, this project simulates some of the general strategies for evaluation in terms of relative risk and returns. The following discussion in Chapter 3 outlines the data that was used in the production and marketing models and Chapter 4 discusses the production parameters and performance measure calculations that were used in this study's computer models.

CHAPTER 3 DATA SOURCES

This chapter provides an explanation of all of the data used in this study. The primary time series data were obtained on daily and weekly time intervals. Monthly price indices were interpolated to provide weekly values where needed for the calculations. Data for the time period from January 1980 to December 1993 was used.

3.1 Live Cattle Prices

The slaughter cattle price series used is the weekly weighted average Alberta direct to packer steer price as calculated by Can-Fax. The prices reflect market conditions for good quality grade A steers, FOB the packing plants which are located primarily in the southern region of the province. These prices can also be found in the Agriculture Canada Publication, *Canada Livestock Meat and Trade Report*, in weekly format prior to 1993 and monthly format after 1993. The feeder cattle prices used are the average weekly prices for; four to five, five to six, six to seven, and over eight hundredweight cattle at the Edmonton Public Livestock Market (EPLM). The EPLM prices reflect the most complete price series available for Alberta feeder cattle.

3.2 Live Cattle Futures Prices

The live cattle futures prices used in this study's hedging and contracting simulations are the daily closing prices for the live cattle futures contracts that are traded on the Chicago Mercantile Exchange. Prices for the February, April, June, August, October and December contracts were purchased from Tick Data Inc.

3.3 Options Prices

Daily settlement prices of put options for each of the CME live cattle futures contracts were purchased from Knight-Ridder. Knight-Ridder is an information engineering company located at: Suite 1810, 30 South Wacker Drive, Chicago Illinois, 60606-7404 (tel. 312-930-1603).

3.4 Forward Contract Basis

The forward contract basis used in this study were obtained directly from the local agents for IBP and Monfort's. The information received included a representative opening and closing basis level for each contract month. The basis ranges were confirmed with samples of actual contracts supplied by Alberta producers. In general the contract basis widens from its starting level as shown in Table 20 in Appendix A. Since the rate at which the basis widens depends upon the supply and demand for finished cattle in the particular time period, the timing of changes from the opening basis is not constant from year to year or from contract to contract. However, given the guidelines provided by the contracting agents, and the observed historical contracts, Table 20 gives a reasonable approximation of the basis levels that a producer would receive.

3.5 Barley Prices

Traditionally, barley grain has been the energy source of choice for Alberta cattle producers. Although some producers have recently included wheat in their least cost ration formulations, barley remains the sole feedgrain of most producers. The barley price used in this study is the per tonne average weekly Red Deer street price and is obtained from weekly surveys of Red Deer feedmills and elevator companies. This price is reported by Alberta Agriculture and is published in the *Alberta Agriculture Statistical Yearbook*.

Barley used in the feed rations of this study is described in pounds and charged out in dollars per pound as follows,

$$Blyp = [(barP - CBOP)/2204.622] \tag{5}$$

where; Blyp is the price of barley in dollars per pound, barP is the Red Deer street price in dollars per tonne, CBOP is the applicable Crow Offset payment and 2204.622 is the number of pounds per tonne.

3.6 WDFB Contract Prices

The daily barley futures prices were obtained from various issues of the Winnipeg Commodity Exchange *Statistical Annual*. The data expressed in dollars per tonne and was converted to dollars per bushel for use in the simulation models.

3.7 Barley Processing (Rolling)

A grain processing charge of $18/tonne (1993 dollars) is added to the price of barley to cover the costs of rolling and shrinkage. The cost is indexed back to the start of the study period using the processed feeds index (Cansim). The processing cost was determined through conversations with producers and is consistent with previous research (Munro, 1993).

3.8 Silage Prices

The traditional source of roughage in Alberta feedlot growing and finishing rations is barley silage. The nutrient content of barley silage is very conducive to the finishing of cattle although supplementary protein is often required. Cattle producers in the parkland and irrigated regions of the province often use alfalfa and other hays in the rations to exploit the productive capabilities of their land and to supply additional protein for the growing phase of cattle feeding. Because there is no complete and accurate price series for hays and haylages, barley silage is the sole roughage used in the rations of this study.

Although barley silage has been predominant for many years, a complete and accurate time series of price is not available. Since barley silage is typically an alternate use of a normal barley crop, the prices charged by custom feedlots and desired by farmer feeders usually reflects the value of the field for barley grain, plus additional harvesting costs.

The location of the hypothetical feedlot of this study is in the Red Deer area of central Alberta where barley yields of 85 bushels per acre and silage yields of 12 tons per acre are typical. With silage crops yielding 12 tons per acre, a cattle feeder will normally have 9.6 tons per acre of marketable silage at 65 percent moisture after storage and handling losses. Given Red Deer area silage yields and using the custom rates quoted in the Alberta Agriculture *Custom Rates Survey*, the cost differential between combining and forage harvesting is approximately 73 dollars per acre. However, given that silage can usually be taken off early with less risk of weather deterioration, and given that there is value in having fields harvested early, the harvest differential used in this study is estimated to be 48 dollars per acre. The harvesting cost differential of 48 dollars per acre in 1993 is deflated over the time series with the western Canada farm input price index (CANSIM). Given these yield and harvesting cost conditions, the price of silage in dollars per pound can be described in terms of the price of barley through the following formula:

$$\text{(6)} \qquad \text{Silage price per ton} = \left[\left(\text{Barley price per bushel} * \ 8.86 \right) + \left(\frac{48 \frac{\$}{acre}}{9.6 \frac{tons}{acre}} \right) \right]$$

This formula gives gross revenues per acre from barley silage which are equal to the revenues from barley grain production after the 48 dollar per acre harvesting cost differential is included. However, it should be noted that this is not a general silage pricing formula. Producers facing different soil, weather and production conditions will have different silage to grain production ratios which will affect the opportunity cost of the silage.

In general, this formula gives a good approximation of the central Alberta silage prices. For example; the barley prices of 1.50, 2.00, 2.50 and 3.00 dollars per bushel give silage prices of 18.30, 22.73, 27.16, and 31.59 dollars per imperial ton.

3.9 Supplement Prices

The rations in this study use a 32% protein beef cattle supplement as source of protein, calcium, phosphorus and trace minerals. Because there is no consistent price series for bulk supplement, a representative price was obtained from Cargil Feeds and then indexed using the prepared feeds price index obtained from the Statistics Canada CANSIM database.

3.10 Interest Rates

The primary interest rate used in this study is the 90 day treasury bill rate for Wednesdays and was obtained from various issues of the *Bank of Canada Review*. The simulations in this study used this interest rate plus 2 percent when considering typical interest costs for cattle, feed and yardage. Large reputable producers would likely have received more favorable terms from their lenders over the time period.

3.11 Exchange Rates

This study uses each Wednesday's closing price for the spot Canadian dollar for converting exported cattle values into Canadian dollar terms. As well, the futures market trading or hedging profits and losses are converted to Canadian dollars using the spot dollar. This price was drawn from the Thursday editions *Financial Post* newspapers for the time period of this study.

3.12 Price Indexes

The Consumer Price Index (CPI) is used in this study to convert nominal costs and returns to real dollars. This index was obtained from various issues of the *Bank of Canada Review*. Other specific indexes applying to veterinary services, western Canadian supplies and services, prepared feed, and farm inputs were used to create time various time series of prices. The indexes were obtained from the CANSIM data base. In all cases, the price indexes were reported monthly. Where weekly values were needed, they were interpolated from the monthly data.

3.13 Trucking Rates

The trucking rates from Edmonton to the Red Deer feedlot and to each of the three slaughter locations was supplied by a reputable Lethbridge trucking firm. The rates were confirmed through conversations with local producers. Because of the lack of a time series of data, the trucking rates were adjusted for the study period using the Western Canada Supply and Services index obtained from Statistics Canada.

3.14 Animal Health Costs

The medicine and processing costs for both the yearlings and the calves were estimated from drug prices supplied by a Red Deer area animal health supply company. The medicine costs include the necessary professional veterinarian services over the feeding period. The 1993 dollar amounts are adjusted over the study period using the western Canadian veterinary services index from Statistics Canada.

3.15 Grading Costs

For cattle contracted to both US packing plants, two Canadian dollars per hundredweight is deducted from the cattle returns. Cattle delivered on contracts do not always conform to the exact specifications of the contracts as described in section 3.2.1. and there can often be too many head that are too heavy, too fat, too light, or do not fall into the allowable limits of the specified yield grades. The two dollar figure is considered to be representative of cattle exported by feeders with some previous experience in cattle contracting and grade estimation. The grading discount is applied equally to both contracting packers considered in this study, however, there are cases where certain types of cattle at different times in the year will perform differently when slaughtered at the different locations. The cattle that are sold to domestic plants in this simulation do not receive the grading discount as the Alberta price data are from live weight sales. The grading discount is held constant over the period of this study.

3.16 Feedlot Charges

Feedlot charges including yardage, bedding, commissions and other miscellaneous items are estimated from actual rates being charged in the industry. The rates in the study do not represent one particular feedlot but are generalization of several feeders. Since every feedlot has its own unique services and billing structure, generalizations must be made. The 1993 prices levels quoted in Table 3 are adjusted over the time period using the western Canadian farm input price index.

3.17 Buying and Selling Costs

Selling costs which include ACC charges, brand inspection, Hartford insurance and veterinary inspections for export cattle are quoted in 1993 dollars and indexed over the time period with the consumer price index. Other than trucking, buying commissions are the only buying costs considered. The buying commissions are also indexed with the CPI.

3.18 Data Summary

A complete summary of the data used and their 1993 price levels is located in Table 18 in Appendix A. The table also lists the indices used for data conversion. The next chapter in this report explains the transformation of the data that were described in this section into performance measures and comparison statistics.

CHAPTER 4 SIMULATION METHODOLOGY

This chapter describes the cattle production and marketing parameters that are used in the cattle feeding and marketing simulation methods. As well, the basic return and statistical calculations are described.

The simulation models developed for this project calculate the profits from the feeding to finish of 650 pound calves and 800 pound yearling steers. The feeder cattle were purchased on the Edmonton cash market and then fed at a hypothetical Red Deer Alberta feedlot. In the base cash marketing scenario, the finished cattle are sold to a southern Alberta packing plant. In the US contracting simulations, the cattle are contracted and shipped to both Iowa Beef Processors in Pasco Washington and Monfort's in Greely Colorado. Contracting to Alberta packers is also simulated.

The results are calculated and presented in per head amounts and average annual returns, however, the individual head results are usually only available to a cattle investor when the cattle are grouped into typical feedlot pen sizes of 100 to 300 head.

The average annual return measure of return is the primary return statistic used in the comparison of different marketing strategies. However, per head returns amounts with interest charged at the 90 t-bill rate plus 2 percent are also presented. Interest is charge to both the cattle inventory and the production expenses. The interest amounts are generally considered as an operating expense in most cattle feeding operations and many cattle feeders measure their returns in this format. The returns with interest costs are also included to provide a comparison of the magnitude of returns between different marketing months, beginning weights and marketing strategies. The following two sections describe the production process used to generate these returns

4.1 Ration Formulation

Cattle performance in the simulations is based upon balanced rations at all weights and stages of production. The production process is divided into three phases where phase 1 is a starting phase and where the cattle gain 1.5 pounds per head per day. Phase two is the transition stage where the cattle are transferred onto a ration with a higher energy level and gain 2.5 pounds per day. Phase 3 is full feed finishing phase where the cattle gain 3.5 pounds per day. All cattle entering the simulation are started out in phase 1 and progress to phase 3 at different rates depending on their incoming weights. The ration specifications for all weight ranges are described in Table 17. The rations in Table 17 are formulated from an Alberta Agriculture ration balancing program and are based on Alberta average nutrient contents for the feeds being used.

The final results are based on the rates of gain resulting from the balanced rations, however, the actual dry matter feed consumption was increased by 5 percent from recommended amounts to better reflect actual physical conditions in central Alberta. Actual performance results from several southern Alberta close-outs indicate performance results which are superior to those used in this study. Thus, the actual level of returns generated in this study must be interpreted by each cattle feeder with respect the cattle feeder's own production history.

A review of the cattle performance parameters by several cattle feeders has confirmed that the feed conversions used in this study are representative of industry results over the years from 1980 to 1993. Weekly calf and yearling feed consumption and overall performance results are contained in Table 3 on the following page.

4.2 Calf Feeding Program

Steer calves weighing 650 pounds are purchased in the third week of each month over the duration of the simulation. The calves are fed to finish at 1190 pounds for domestic slaughter and 1301 pounds for export slaughter. The finishing weights remain constant throughout the time period although in reality, cattle weights tend vary somewhat due to production costs, market conditions and packer demands. However, these finishing weights are believed to be reasonable by industry stakeholders.

Calves in the simulations received a full processing treatment upon arrival at the feedlot. The vaccination, and induction procedures cost the hypothetical cattle feeder 9.50 dollars per head in 1993 dollars. The calves also received therapeutic treatments which cost 22.50 dollars per head. The average death loss for calves in this study was 2 percent. These treatment costs and mortality rates were deemed to be reasonable by cattle feeders, veterinarians, and animal supply company representatives. The treatment and induction costs were indexed throughout the study period using the veterinary supply and services index. As in the yearling program described in the following section, the calves received bedding at a cost of 6 cents per head per day in the months from November to March inclusive.

4.3 Yearling Program

The yearling simulations represent the feeding of 800 pound yearling steers to market weights of 1203 pounds for domestic slaughter and 1298 pounds for export slaughter. As with the calves, the market weights remain constant through out the feeding period. The lots of cattle are purchased in the third week of each month of the year and are shipped to domestic and foreign slaughter after 17 and 21 weeks in the feedlot respectively. The feeding performance results for the yearlings are also shown in Table 3.

The yearlings received a full processing treatment upon arrival at the feedlot. As with the calves, induction costs were deemed to be 9.50 dollars per head. In contrast to the calves, therapeutic treatment cost used was 6.50 dollars per head. The simulation models assumed the yearling death loss to be 1 percent. The death loss amount accounts for all animals not walking on the truck and receiving full market value. Several actual close-out records indicate that the actual average yearling death losses may be slightly less than one percent, thus, the simulated level of returns must be adjusted to reflect each cattle feeder's own production history.

Table 3. Cattle Performance And Dry Matter Feed Consumption

Destination	In Lbs	Head days	Head wks.	Out Lbs	ADG	D.M conv	Ph.1 days	Ph.2 days	Ph.3 days	Bly lb/wk	Sil lb/wk	32% lb/wk
Calves												
Domestic	650	182	26	1193	3.04	6.96	28	28	126	138	6	6.1
Export	650	210	30	1301	3.36	7.15	28	28	154	147	6	6.7
Yearlings												
Domestic	800	119	17	1203	3.10	7.10	3	11	106	165	5	6.3
Export	800	147	21	1298	3.38	7.34	3	11	133	173	5	6.8

The parameters in Table 3 are for the domestic and US production of calves and yearlings. The number of days that the cattle are on starting, transition, and finishing rations are shown in Ph.1, Ph.2 and Ph.3 columns respectively. The average weekly consumption amounts of barley , silage and supplement are shown in three right hand columns. The average daily gain and dry matter conversions are shown by the ADG and D.M conv. columns. These performance results and production parameters remain constant throughout all of this study's simulations. These parameters provide the base for the cost calculations which are outlined in the following section.

4.4 Cost Calculations

This section outlines the cost calculations which are embedded in this project's computer simulation models. This cost structure is typical of many farm and commercial feedlots and is confirmed by discussions with several cattle feeders. The cost structure used in the simulation models consists of the following components with their abbreviations:

1. cost of the feeder steer ($/hd), ***CatC***
2. feed barley ($/lb), ***Blyp***
3. barley silage ($/lb), ***Silp***
4. 32% beef cattle supplement ($/lb), ***Sup***
5. bedding from November to March ($/hd/day), ***Bed***
6. barley processing charges ($/lb), ***Bpro***
7. incoming cattle processing charges ($/hd), ***Cpro***
8. sick animal treatment costs ($/hd), ***Cmed***
9. daily yardage charges ($/hd/day), ***Ydge***
10. interest on cattle investment(%/week), ***Cint***
11. interest on production expenses (%/week), ***Fint***
12. Buying commissions ($/head), ***Com***
13. trucking in ($/cwt), ***Intrk***

Upon arrival at the feedlot, each lot of cattle is charged with the cost of the cattle, trucking in, commissions and processing costs. Amounts of processed feed are calculated and averaged over each week of the feeding period along with the yardage charge. Bedding is charged out in the week used. Treatment medicine costs are averaged over the first 8 weeks for calves and first four weeks for yearlings. Death loss is assumed to occur after 8 weeks on feed for calves and four weeks for yearlings. Interest on the cattle and the production costs is calculated weekly. Trucking out, selling costs and grading costs are deducted from the gross revenue of the animals at the end of the feeding period.

The laid in costs per head (***LinC***) are described by equation (7).

$$LinC = CatC + (Intrk * inwt) + Com + Cpro \tag{7}$$

where: ***CatC*** is the incoming weight times the feeder price, and ***inwt*** is the incoming weight of the animals. The average weekly production costs before and after death loss occurrs are represented by $\boldsymbol{ProC_B}$ and $\boldsymbol{ProC_A}$ in equations 8 and 9. It is assumed that all of the death loss occurs at the end of four weeks on feed. Equations(8) and (9) include interest charges while equations (10) and (11) are the production costs without interest.

(8) $$ProC_B = [((((Blyp + Bpro) * Blbs) + (Silp * Sillbs) + (SupP * Sulbs) + (Cmed / weeks) + (Ydge + bed)) * 7) * (1 + Fint)] + C\text{int}$$

(9) $$ProC_B = [((((Blyp + Bpro) * Blbs) + (Silp * Sillbs) + (SupP * Sulbs) + (Cmed / weeks) + (Ydge + bed)) * (7 * (1 - DL))) * (1 + Fint)] + C\text{int}$$

(10) $$ProC_B = (((Blyp + Bpro) * Blbs) + (Silp * Sillbs) + (SupP * Sulbs) + (Cmed / weeks) + (Ydge + bed)) * 7$$

(11) $$ProC_A = (((Blyp + Bpro) * Blbs) + (Silp * Sillbs) + (SupP * Sulbs) + (Cmed / weeks) + (Ydge + bed)) * 7 * (1 - DL)$$

where:

1.Blbs, Sillbs and Sulbs are the average weekly pounds of barley, silage and supplement
2. DL is fractional death loss for the lot
3. $Fint$ = (the week's 90 day t bill rate +.02)/52
4. $Cint = LinC$ *(the week's 90 day t bill rate +.02)/52

Total production costs in nominal dollars per head (***TPC***) is then:

(12) $$TPC = \left[\sum_{1}^{W_B} ProC_A + \sum_{W_B}^{W} ProC_B\right]$$

where: ***W*** is the weeks on feed and $\boldsymbol{W_B}$ is the weeks on feed before death loss occurs.

The total cost of the finished animal at the end of the feeding period in constant dollars($\boldsymbol{TC^R}$) is then;

(13) $$TC^R = (TPC + LinC) * \left(\frac{CPI_{June86}}{CPI_{t-WOF}}\right)$$

With the total cost calculations complete, the computer models then calculate revenues based on the historical data. The next sections in this report outline the revenue and return calculations used in the simulations.

4.5 Revenue Calculation

The gross revenues from each lot of cattle consist of the actual price per pound times the finished weight less the following marketing costs:

1. Trucking to the plant ***Outtruck***
2. ACC ,brands and miscellaneous ***AccB***
3. grading costs ***Gdis*** (as per section 3.15)
4. veterinary inspections ***VetD***

Nominal gross revenue (Grev) per head for cattle sold domestically is then:

$$(14) \quad Grev_{Domestic} = [Outlbs * (OutP - Outtruck)] - AccB$$

where ***Outlbs*** is the finished weight and ***OutP*** is the selling price per pound. The finished weight is the shrunk weight FOB the feedlot. For cattle shipped to the United States, gross revenue is calculated as follows:

$$(15) Grev_{Export} = \left[Outlbs * \left(\frac{(CMEP - Bas)}{ER} \right) \right] - \left[(Outtruck + Gdis) * Outlbs \right] - AccB - VetD$$

Where CMEP is the US dollar price, Bas is the US dollar Basis and ER is the value of the Canadian dollar in terms of the U.S. dollar.

The net revenue amounts for each pen of cattle are then calculated as in equation (16) where TC is the nominal TPC plus the nominal Linc. The net revenue calculation is completed both with and without interest calculated on the cattle and feed investments. The net revenue figure is then converted into constant 1986 dollars using equation (17)

$$(16) \qquad NRev^{N} = Grev - TC$$

$$(17) \qquad N\mathrm{Re}\,v^{R} = N\mathrm{Re}\,v^{N} * \frac{CPI_{June86}}{CPI_{t}}$$

where: CPI subscript t indicates the CPI in the time period the cattle are sold. $NRev^{R}$ is the real return in dollars per head. The results in this study will use the terms 'profit' and 'per head returns' the represent the real net revenue as calculated in equation 17. The real net revenue figure in its 'without interest' form provides the basis for the annual return calculations in the following section.

4.6 Annual Return Calculations

For the comparison of different feeding and marketing strategies and the comparison with other investments, it is important to look at the annualized rates of return expressed as percent returns. Total return can be expressed as an annualized rate of return for each animal that is finished. The annualized return equalizes the length of time among the alternatives. As well, the effects of inflation during the feeding period are removed by adjusting the total costs with the consumer price index (CPI) resulting in a real return. By adjusting the cattle and production costs to the time period of the cattle sales, the revenue and cost amounts can be readily compared. The average annual return is calculated using the following discounting formula where DOF is the number of days on feed:

$$(18) \qquad AveAnn\mathrm{Re}\,t = \left[\left(\frac{Net\,\mathrm{Re}\,v^{N}}{TC^{R}} + 1 \right)^{\left(\frac{365}{DOF}\right)} - 1 \right] * 100$$

4.7 Reporting of Returns

All of the previously described return statistics are reported as average monthly and average total figures. Standard deviations of returns are also reported for each month and for total number of pens. These mean ($\bar{x}$) and standard deviation (s) numbers are calculated in the usual way where:

$$(19) \qquad \bar{x} = \sum_{i=1}^{pens} \frac{x_i}{pens}$$

$$(20) \qquad s = \sqrt{\frac{\sum \left(x_i - \bar{x}_i \right)^2}{pens - 1}}$$

and subscript i is an individual pen.

Confidence intervals were also calculated for many of the descriptive statistics. The confidence intervals(CI) were calculated as follows where the confidence interval is equal to the mean plus and minus the half-width (Hw).

(21) $$CI = \left(\bar{X} - Hw, \bar{X} + Hw\right)$$

The half width is calculated in the following way where:

(22) $$Hw = t * \frac{s}{\sqrt{n}}$$

and t is the test statistic from the t distribution and $s/n0^{0.5}$ is the standard error of the mean. The net return per head (after interest cost deductions) and annual return statistics as calculated in this chapter are used to describe the results from the simulations in the next and subsequent chapters.

The term 'pen' is used throughout this report to represent the production and marketing of one animal in one feeding period as defined by the appropriate days on feed. In all of the simulations models, one 'pen' is purchased in the third week of each month over the duration of the simulation time periods. Thus, for the 1980 to 1993 time period, results were generated for 162 pens of cattle. This study recognizes that the per head results are only available to cattle feeders when an appropriate sized group or 'pen' of animals is fed. The appropriate group size varies from feedlot to feedlot, however, 100 to 200 head is a typical pen size.

CHAPTER 5 SIMULATION RESULTS

This chapter uses the data described in Chapter 3 and the parameters described in Chapter 4 to simulate the finishing and marketing of cattle. The previously defined production parameters remain constant throughout all of the simulation models in this report.

The marketing simulations in this chapter are chosen to highlight various components of Alberta cattle feeding returns and risk. The Alberta cash marketing simulation results are the base results used for comparing alternative strategies. Alternative strategies included in this chapter are; routine hedging, routine contracting to US packers, routine basis contracting to US packers, selective target price contracting to US plants, selective feeding and selective feeding and US contracting with moving average pricing decisions(NF-MA strategy). Due to the lack of Alberta contracting data, Alberta contracts are not simulated in this chapter.

The discussion begins with the Alberta cash marketing results and concludes with a market based risk return comparison of the various strategies. A summary of the individual strategy results is located in Table 23 in Appendix B.

5.1 Results of Cash Marketing Simulations

The following results were obtained from shipping one pen of cattle per month to a southern Alberta packing plant using the input parameters described in the previous chapters. Calves were fed for 182 days and the yearlings were fed for 119 days before being sold on the domestic market.

Cattle returns are presented dollars per head after interest has been deducted and as average annual returns as desribed in chapter 4. Figures 6 and 7 show the returns for each pen of cattle over the entire time period from 1980 to 1993. The mean returns and standard deviations of returns of the simulated pens of cattle are also reported by month sold, in Table 20 in Appendix B. All of the return numbers reported are in constant 1986 dollars.

Figure 6. Average Annual Returns from Cash Marketing

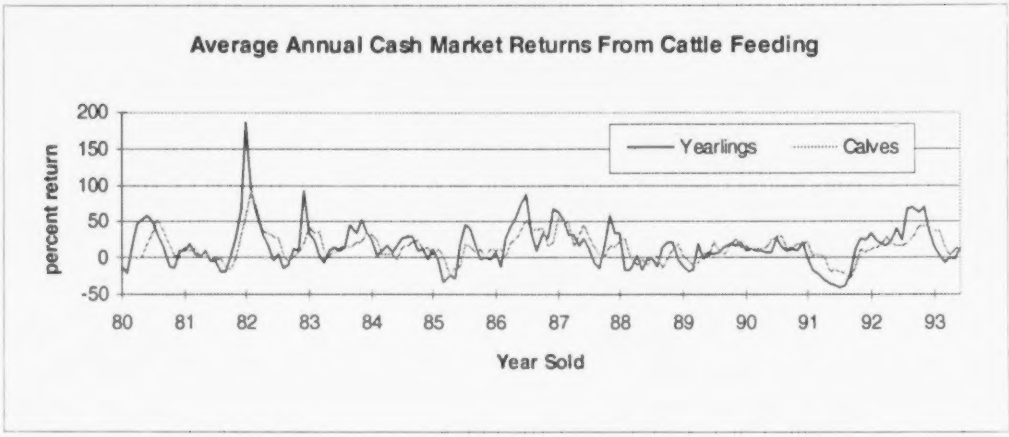
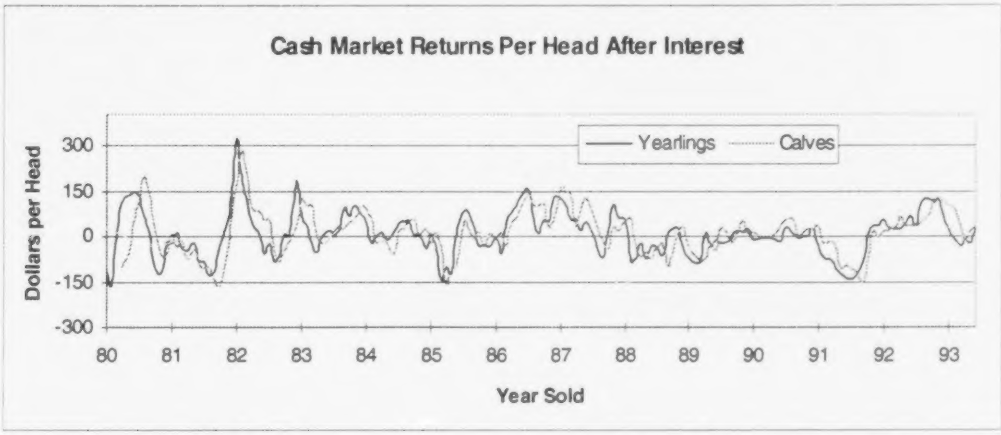


Figure 6 shows a rather volatile series of annual returns over the time period for both yearlings and calves. The returns ranged from -39.5 percent to as high as +186.4 percent for one pen of yearlings. The returns were mostly between -50 and +50 percent, with mean returns of 16.63 and 15.23 percent for yealings and calves respectively. The figure also shows more volatile returns for yearlings compared to calves although the returns follow the same general pattern.

Figure 7 shows the same information as Figure 6 except that the returns are expressed in dollars per head after interest. The results show maximum returns of approximately 300 dollars per head in 1982 with maximum losses reaching over 150 dollars per head on 4 occasions. The returns mostly ranged between +150 and -150 dollars per head and had means of 6.90 and 12.89 dollars per head for yearlings and calves respectively.

Figure 7. Returns from Cash Marketing with Interest in Dollars per Head (1986=100)



Of note in both figures 6 and 7 is the lengthy period of large losses in 1991 and 1985. From 1980 to 1993 there were nine consecutive losing pens, with seven consecutive pens losing more than 50 dollars per head. There were also four consecutive losing months in 1985 of which three pens lost more than 100 dollars per head. Both of these losing time periods had the potential to severely reduce the equity of some cattle feeding operations.

It is suggested by some cattle feeders and industry participants that these large losses are due, in part, to the influence of various Provincial and Federal Government programs and the NTSP. In the early eighties, strong competition for a larger share of the cattle industry by different provincial governments resulted in the formation of the NTSP in 1986. After experiencing the severe losses in 1985, producers readily joined the NTSP. The NTSP effectively compensated producers for the large losses which may have been made more severe with initial government intervention into the cattle industry.

Changes in production costs may also have played a role in the magnitude of the losses. However, as was shown in Figure 2, the barley prices in 1991 exhibited a general downward trend during the time period. Feed costs in 1985 were also in a general downtrend.

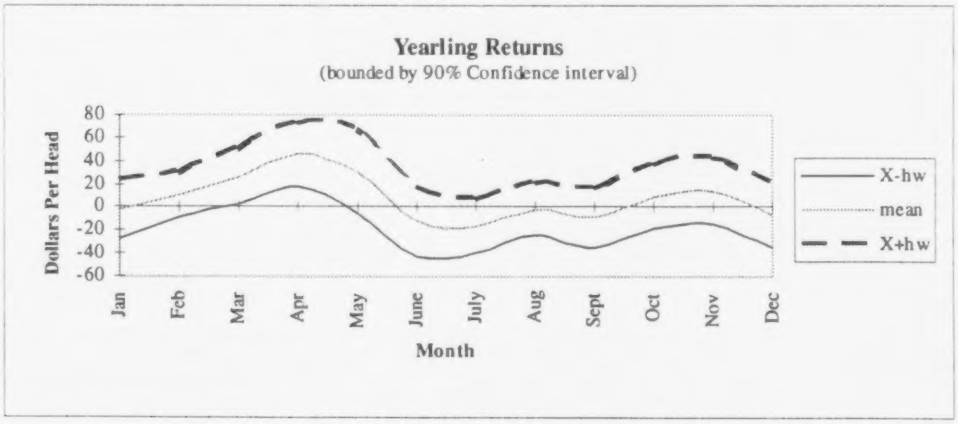
As with the 1985 losses, the losses in 1991 cannot be entirely attributed to market forces alone. After several years of NTSP operation, producers and packers became familiar with the payout mechanism. Thus, payouts were projected reasonably well and producer objectives switched towards maximizing total returns, rather than just market returns. In periods with high expected payments, some producers had the opportunity to pull cattle ahead to capture extra NTSP payments.

Packing plants were also in a position to capitalize on NTSP payments as they would discount bids when producers were essentially dumping cattle onto the market to get higher NTSP payments. One likely consequence of this action was a widening of the basis to near record levels. As a result of the production and marketing patterns in 1991, there were 7 consecutive months with NTSP payments. The payments reached a maximum of 189.53 dollars per head in November 1991.

Although it is very likely that government programs had an impact on the magnitude and duration of the losses during the time period, we cannot rule out the possibility of future adverse market movements resulting from unknown factors. Thus, one objective of the following simulations is to identify market based strategies that would have minimized the big losses in the early 80s, 1985 and 1991.

The per head returns that were shown in Figure 7 have been sorted and analyzed according to the month in which the cattle were sold. A 90 percent confidence interval was placed around the monthly average returns. The monthly results for yearlings and calves are shown in Figures 8 and 9.

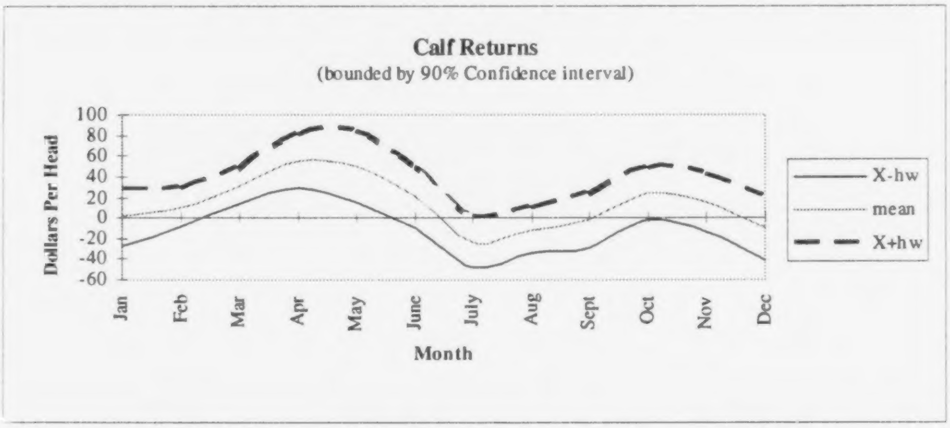
Figure 8. Average Monthly Yearling Returns



From the results shown in Figure 8, a monthly pattern of returns is apparent. Seasonal highs are reached in March, April and May while lows are reached during the summer months. The upper and lower lines in the figure indicate the range in which we can be 90 percent confident of the true mean falling. The relatively high returns for yearlings in the spring are most likely due to the seasonal nature of cattle production where the supply of yearlings placed on feed in the fall begins to dry up and the run of finished calves is only beginning to come onto the market. Lower returns in the summer months are partly due to the market competition for a relatively low supply of high quality feeder cattle in the spring months. An increase in mean returns in October and November is most likely due to relatively low supply of finished cattle as yearlings come off grass in late August and September are only beginning to hit the market.

Calf returns show comparable seasonal patterns to yearling returns. However, the low level of returns in July is somewhat more pronounced. From this figure, we can be 90 percent confident that the true mean in July is not greater than zero.

Figure 9. Average Monthly Calf Returns



The low returns in July are likely due to two key factors; the seasonally large supply of fat cattle in the summer resulting in lower prices and a general shortage of feeder cattle late in the year resulting in higher costs. The 650 pound calves finished in the summer would have been purchased on the December and January feeder markets. The feeder markets during these months are influenced by shortages of supply due to seasonal production and weather patterns. As well, feeder cattle demand is often influenced by an increase in tax avoidance spending patterns late in the year.

Although the season patterns indicate that extraordinary profits can be made by targeting production to the spring and early winter months, the higher returns come with generally higher production and transactions costs. Lower numbers of feeder cattle available in certain months results in the slow filling of pens and transportation costs which may be higher than those used in this report. Animal health costs are also increased when cattle are placed slowly. The average quality of feeder cattle on the market at various times of the year may also have an impact on profitability in some months. Because this study uses average weekly EPLM feeder prices, there is no way of knowing the exact variation in animal quality. Differences in frame size and flesh condition will affect cattle performance and days on feed. Thus, the reported monthly average returns may not accurately reflect true cattle feeding results. However, there can be little doubt that seasonal return patterns do exist.

Overall, the cash market simulations in this section have shown average real annual returns of 15.23 percent for calves and 16.63 percent for yearlings. For a producer to achieve these average annual return results, the feedlot would have had to process a continuous flow of cattle over the time period. Although the yearling returns are slightly higher than the calf returns, the variability of yearling returns is considerably higher. The standard deviation of annual returns for yearlings of 29.52% (Table 4) is approximately 60% higher than the standard deviation for calves of 18.87%. The differences between these two numbers indicates that the returns from feeding yearlings are more volatile. The standard deviation number gives a rough initial measure of the comparative levels of risk associated with feeding calves and yearlings.

The simulations in the following sections will report the risk and returns from the use of alternative marketing instruments in comparison to this cash marketing strategy. Mean returns, standard deviation of returns and minimum returns are the primary statistics used for comparing each group of 162 simulated pens. However, the frequency distribution of returns from different simulated strategies is also presented and discussed later.

Table 22 in Appendix B is a summary of the descriptive statistics for this cash marketing strategy and the alternative marketing strategies that are described in the following sections of this chapter. These descriptive statistics include the observed mean, maximum, minimum and standard deviation of returns along with the number of pens with returns less 50 dollars per head and greater than 50 dollars per head. The number of pens with annual returns greater than 50 percent and less than 0 percent are also reported.

5.2 Routine Hedging

This section examines the returns from routine use of a CME futures contract hedge on each pen of cattle fed. Routine hedging involves going short the futures on the day the cattle are purchased and then offsetting the hedge on the day the cattle are sold to an Alberta packing plant. The routine hedge results are in section 5.2.1 while the analysis in section 5.2.2 examines the historical adverse futures price movements which represent the potential for margin calls with routine hedging.

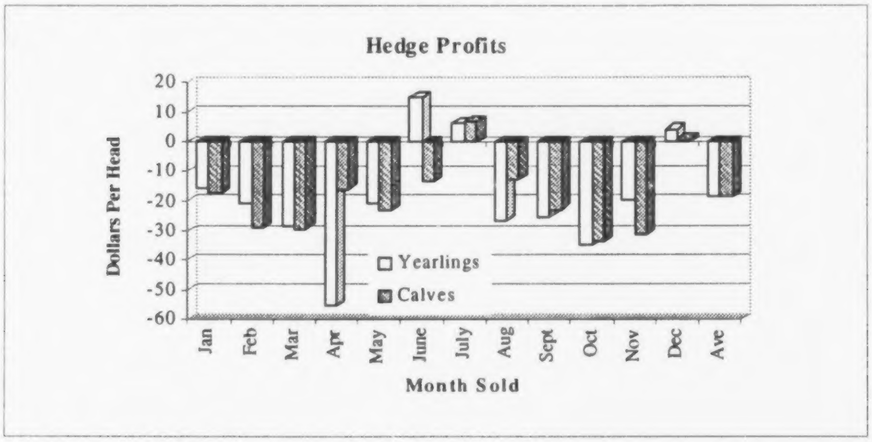
5.2.1 Results of Routine Hedging and Cash Marketing Simulations

The results of the routine hedging simulation give an indication of value of 'locking in' the cattle price using only the futures price. In these simulations, the returns are subject to changes in the basis and changes in the Canada - US exchange rate.

The futures contracts are routinely sold on the day the cattle are purchased and then offset when the cattle are sold on the domestic market. Returns are calculated using the spot dollar on the day of each transaction. In this case, it is assumed that the lot of cattle perfectly fits the 40,000 pound CME contract size when the cattle are sold. It is also assumed that there are no margin requirements, margin calls or brokerage fees. Returns from the actual futures market transactions are reported separately in Figure 10 and then combined with cash market returns for a net return per pen, or combined hedge-cash marketing return.

Figure 10 shows the average and monthly per head returns from the routine hedge trades. From this figure it is apparent that the trading strategy provides generally negative results with an average per head loss of approximately 20 dollars. Routinely hedging the cattle during the months of June, July and December has provided small positive average returns with the strategy.

Figure 10. Returns from Routine Hedge Trades



The routine contracting strategy has reduced the mean per head returns when combined with the cash marketing scenario that was described in section 5.2. However, the strategy has contributed to reducing the price risk. This is shown by the reduced standard deviation of returns in Table 4. Table 4 shows the average annual returns from cash marketing compared to the combined routine hedge and cash marketing strategy.

Table 4. Cash and Routine Hedge Average Annual Returns and Standard Deviations

	Cash Marketing (%)	Routine Hedging (%)
Calves	15.23	11.07
	(18.46)	(14.13)
	[-29.45]	[-25.43]
Yearlings	16.63	7.58
	(29.52)	(21.55)
	[-39.49]	[-41.76]

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

The annual return results in Table 4 indicate that routinely hedging the cattle has reduced the mean returns for calves by 27 percent and yearlings by 54 percent. However, the strategy has succeeded in reducing the price risk by 30 percent for calves and 37 percent for yearlings as measured by the change in standard deviation.

As shown by the minimum observed returns, routine hedging has not been entirely successful in limiting losses. Minimum yearling returns were lowered from -39.49 to -41.76 percent while minimum calf returns were raised from -29.45 to -25.43 percent. This indicates that the futures contract may have value in reducing the magnitude of large losses for cattle with longer feeding periods. However, the routine use of the futures contract does not appear to have a high value in reducing potentially large losses for short keep cattle.

It is quite likely that the reduced returns from the routine hedging strategy will be unacceptable to most producers even with the lower risk levels. However, it is important to recognize that the CME futures contract does have value in reducing price volatility and price risk at the cost of reduced average returns and transactions costs. The next section considers a type of futures market transaction cost which is associated with this type of futures position.

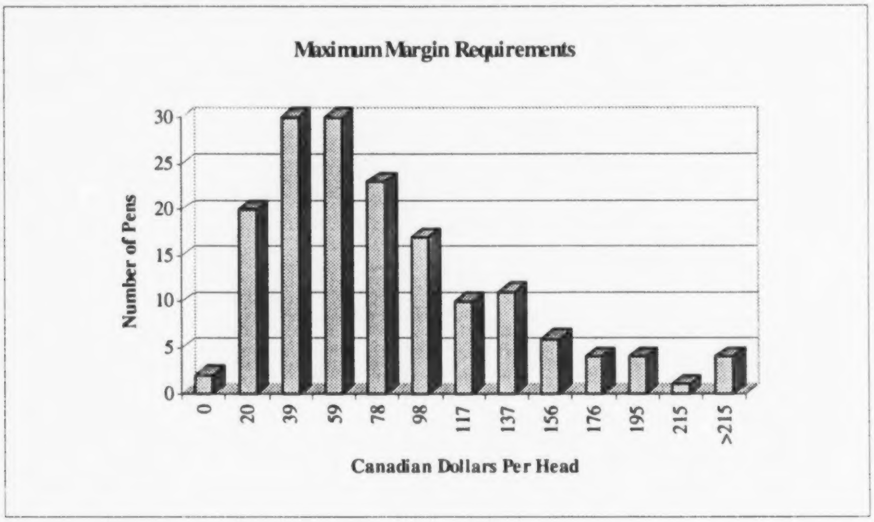
5.2.2 Margin Analysis

Since routine hedging involves going short the futures contract for the entire length of the feeding period it is important to look at the potential margin costs of the strategy. With futures trading accounts marked to market at the end of each trading day, hedgers are often required to forward cash payments or margin calls to a brokerage firm within a few days of an upward move in the market. Some hedgers may not have the ability to acquire the required amounts of cash on short notice to fulfill their market obligations. As well, some producers may encounter resistance from the lending institutions that are providing the firm's operating capital.

In addition to the financial constraints in maintaining a hedging account, some producers report experiencing strong psychological constraints when faced with adverse futures price moves. When the psychological and financial constraints become binding on the producer, hedges may be lifted at inopportune times. Producers report that on some occasions, short hedges are lifted at points in the time when the futures market is just about to turn down. Hedgers not adhering to a disciplined hedging strategy may experience reduced hedging effectiveness.

Given that psychological and financial constraints are important to the effectiveness of hedging strategies, it is important to examine the potential price moves which will negatively affect a hedgers trading account. The results in Figure 11 show the distribution of adverse price movements expressed in dollars per head amounts. This analysis tracks the maximum daily futures prices in the pens of yearlings that were fed in the previous cash marketing and routine hedging strategies.

Figure 11. Maximum Potential Margin Requirements



The results in Figure 11 show a high probability of having maximum margin requirements in the range from 20 to 100 dollars per head. Of 162 pens fed, there were 20 pens with price movements from zero to 20 dollars per head and 30 pens each from 20 to 39 and 40 to 59 dollars per head. Two pens were hedged near a top in the market and did not experience any adverse price movements. The maximum adverse price movement was 234.59 dollars per head.

From the distribution of potential margin calls, it is apparent that hedging with futures can require high levels of liquid capital. In reality, few hedgers would use the routine hedging strategy as described in the previous section, however, the number and magnitude of potential margin calls does imply some financial requirements over and above the cash marketing strategy. In order for hedgers to minimize the costs of margin calls, additional management costs will occur. Producers report that managing an effective futures market hedging strategy requires considerable management time along with increased market information costs.

The results of the margin analysis show that hedging with futures can be expensive in terms of financial requirements. The financial costs combined with psychological challenges contribute to a movement by producers towards the use of forward contracts and short put options; tools which do not involve the daily marking to market process. The routine contracting simulations in the next section do not experience negative effects from the averse price movements as described in this section.

5.3 Routine Contracting Results

The following results shown in Figures 12 and 13 are derived from routinely contracting each pen of cattle to US packing plants. This and other US contracting simulations ask the question: What would have been the risks and returns over the time period if the contracts were available, and if we had contracted and priced the cattle in this particular way? Since the cattle contracts were not widely used in the early 1980s, it is unlikely that the reported results would have been received by a large number of cattle feeders during the time period. However, the results from this simulation will shed some light on the value of locking in a basis level with US contracting.

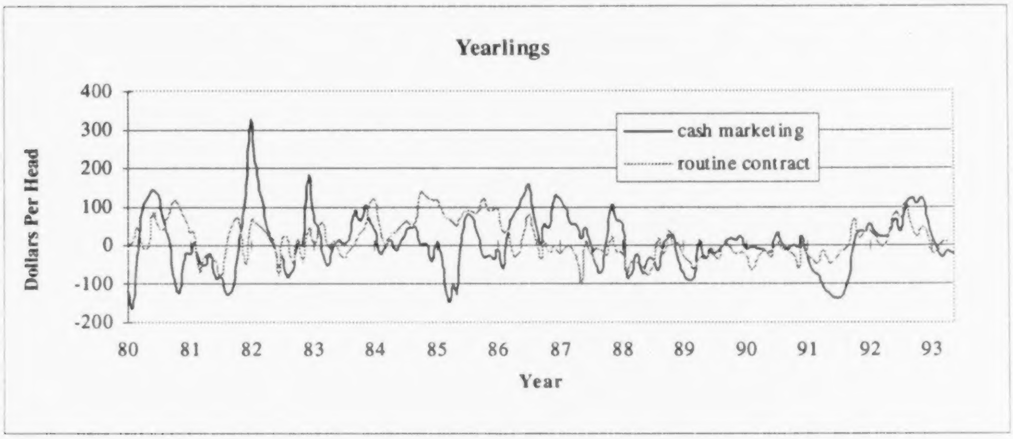
In these simulations, the calves and yearlings are fed four weeks longer on a high energy ration. The simulations incorporate two new factors into the model, the first being the longer feeding period and the second being the basis predetermination. Because of the very small amount of publicly available Alberta contract information, the US contracting is used. Thus, when comparing the risk and return trade-offs between cash marketing and US contracting, consideration must be given to changes in the firm's production system and potential in production risk. Potential changes include higher morbidity and mortality, and feed conversion variability.

The pricing mechanism used in the routine contracting strategy is very different from the cash marketing case. The strategy involves locking in the basis and the cattle price on the day the cattle are purchased. In this strategy, the cattle feeder receives the market price that the futures market offers, or forecasts, at the start of the feeding period. If the futures market is forecasting a loss at the beginning, the cattle will lose money and visa versa.

This study defines a routine contract as a production contract where on the days the cattle are purchased, the basis is set and the cattle are priced using the day's closing CME futures price for the relevant contract month. The basis levels used in these simulations were obtained from agents for the US packers and were confirmed by some actual contract records. The basis levels are located in Table 19 in Appendix A. The simulation model contracted cattle to the US packing plant which offered the highest return to the individual pen of cattle. It should be noted that both US plants used in this study contracted a number of pens in the simulation.

Graphical representations of the routine contracting results as compared to the cash marketing results are provided below. Figure 12 shows that routine contracting of yearlings has been quite successful in minimizing large losses. The strategy has reduced the large cash market losses in the early 1985 and 1991. However, the strategy did not totally remove the large losses in the early 1980s and actually produced negative returns in 1986 and 1987 when the cash market returns were positive.

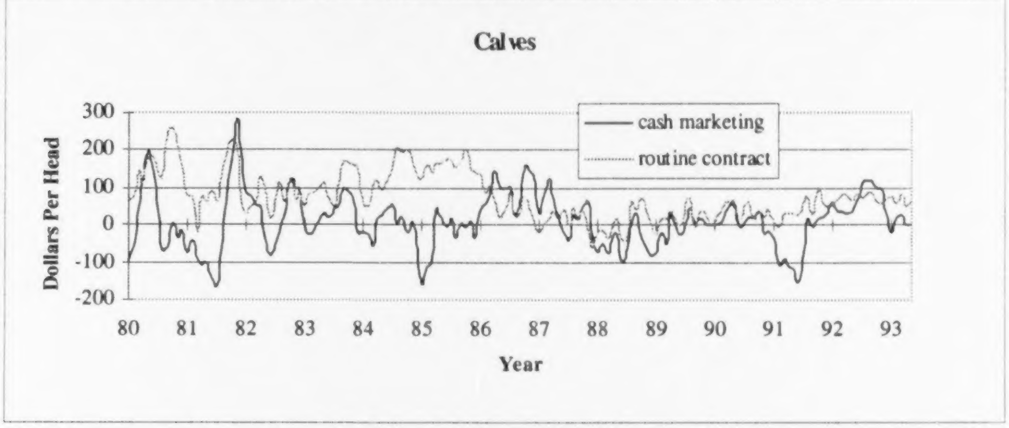
Figure 12. Routine Contracting vs. Cash Marketing Yearlings



The minimum returns from the strategy have been improved somewhat with minimum returns of approximately -100 dollars per head occurring in 1981 and 1987. Also of note in Figure 12 is the reduction in potentially large profits which occurred in 1982 and from 1986 to 1988.

The results of routinely contracted calves in Figure 13 show the same pattern of results as with the yearlings, however, the losses in 1981 and 1987 were virtually eliminated. As with the yearlings, returns from 1988 to 1991 were comparable between the routine contracting and cash marketing.

Figure 13. Routine Contracting vs. Cash Marketing Calves



The generally positive returns are consistent with higher and more stable average annual returns. Table 5 compares routine contracting with the cash marketing strategy using the annual return results.

Table 5. Cash and Routine Contracting Annual Returns

	Cash Marketing	Routine Contracting	Percent Change
Calves	15.23	16.97	11.42
	(18.46)	(11.30)	-38.78
	[-29.45]	[-10.33]	64.92
Yearlings	16.63	13.64	-17.98
	(29.52)	(14.07)	-52.34
	[-39.49]	[-17.06]	56.80

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

The results show an 11.42 percent improvement in return for calves and a 17.88 percent decrease in yearling returns when compared to the cash marketing case. Although the return levels were up and down, both the calves and yearlings experienced large decreases in the amount of return variability as shown by the decreases in standard deviation. Calves experienced a decrease of 38.78 percent while yearlings experienced a decrease of 52.34 percent. The minimum observed return levels were also increased by over half of their original levels.

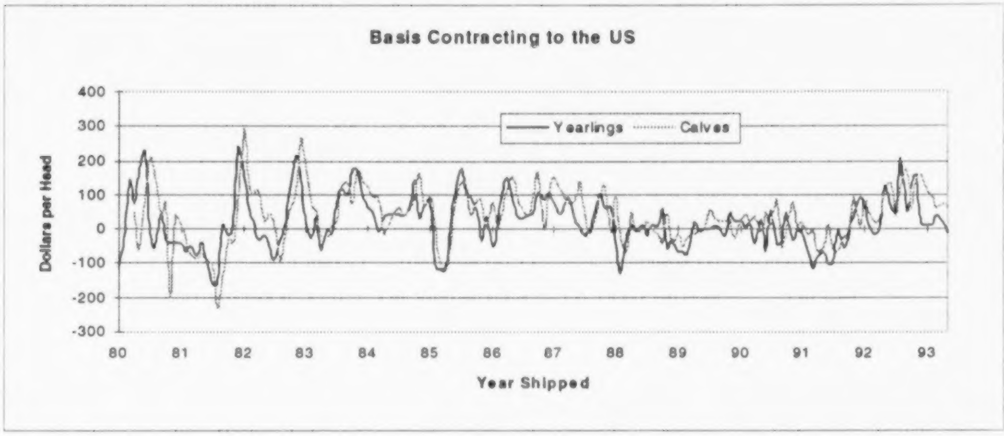
These results show positive risk reducing benefits from routine contracting to US plants, however, it must be recognized that this strategy has some major changes from the original cash marketing strategy. The length of the feeding period and the associated extra weight gains likely contributed to changes in return levels. As well, the US contracting strategy did not include any increase in production risk when compared to the cash marketing alternative. Experienced cattle feeders reported no increases in production risk, however, there is a management cost to learning the US grading and marketing system. Cattle feeders unfamiliar with the physical animal characteristics required to achieve the US grades will often receive higher grading and yield discounts until familiarity with the system is achieved. Thus, decreases in return risk from US contracting strategies could be partially offset by increases in production risk.

Results from 1987 to 1993 which are presented later in this report show the mean and standard deviation of returns over the period from 1980 to 1993 may be misleading. Risk reduction in the later period routine contracts comes at a higher cost in terms of reduced annual returns. In the 1987 to 1993 time period, cash market calf returns were decreased from 15.04 to 11.65 percent with routine contracting while the standard deviation dropped from 18.12 to 7.54. Yearling returns dropped from 13.91 to 6.36 percent while the standard deviation dropped from 26.25 to 10.86 when comparing cash marketing to routine contracting. Thus, the results in Table 5 are a function of the market forces that were present in the time period of the simulations. Producers indicate that the business has become so competitive that are very few occasions when cattle can be purchased with a forecasted positive return based on a futures market price on the day the cattle are purchased. The simulation in the next section uses the same general process as this routine contacting strategy with changes in the days when the cattle are priced.

5.4 Routine US Basis Contracting Results

The routine basis contracts in this simulation involve contracting the cattle to a US plant on the days the cattle are purchased as in the previous section. However, in this case the cattle prices are not 'locked in' until the final feeding day when they are priced with the day's closing futures market price. Comparing these simulation results with the previous routine contracting results will give an indication of the relative advantage of locking in the price at a later time. Figure 14 shows the basis contracting results from 1980 to 1993.

Figure 14. Basis Contract Returns



The results in Figure 14 show a large amount of volatility compared to the routine contracting results in Figures 12 and 13. The magnitude of the negative returns is greater than with routine contracting as shown by several occurrences of negative returns of less than -100 dollars per head. Table 6 gives a comparison of the returns between routine contracting, basis contracting, and cash marketing.

The mean returns from basis contracting are higher than the returns from routine contracting and cash marketing for both calves and yearlings. This is partly due to the favorable basis levels that are available early on in the feeding period.

Table 6. Cash and Contracting Annual Returns

	Cash Marketing	Routine Contracting	Basis Contracting
Calves	15.23	16.97	20.06
	(18.46)	(11.30)	(15.54)
	[-29.45]	[-10.33]	[-19.28]
Yearlings	16.63	13.64	18.19
	(29.52)	(14.07)	(22.39)
	[-39.49]	[-17.06]	[-27.74]

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

Along with the increased returns is an increase in the return volatility as shown by the standard deviation figures which are approximately 30 percent larger than in the routine contracting case. However, the standard deviation remains lower than it was with cash marketing. The minimum returns are also lower for both calves and yearlings with the minimum returns being slightly better than those received from the cash marketing strategy.

The results of these simulations show that locking in the basis at the start of the feeding period and pricing the cattle at the end of the period has increased the returns and decreased risk compared to the cash marketing strategy. However, at this point it is uncertain whether setting the basis really matters in the big picture. By leaving the cattle un-priced, both risk and returns are increased in comparison to the routine contracting strategy where prices were set at the start. Thus there appears to be value in setting the basis at the start and pricing the cattle at a later date. This will be examined in the following sections by introducing target pricing rules into the models.

5.5 Selective US Contracting With 40 Dollar Target

Given that the routine contracting strategy in section 5.5 has shown positive results in stabilizing and increasing returns from 1980 to 1993, the following selective contracting strategy was developed in an attempt to further increase returns while reducing risk. The selective contracting strategy is a combination of the cash marketing strategy and contracting to US plants. This type of joint US contracting and Alberta cash marketing is sometimes used by producers. Some cattle feeders prefer to use US contracts only as a within-feeding-period marketing alternative.

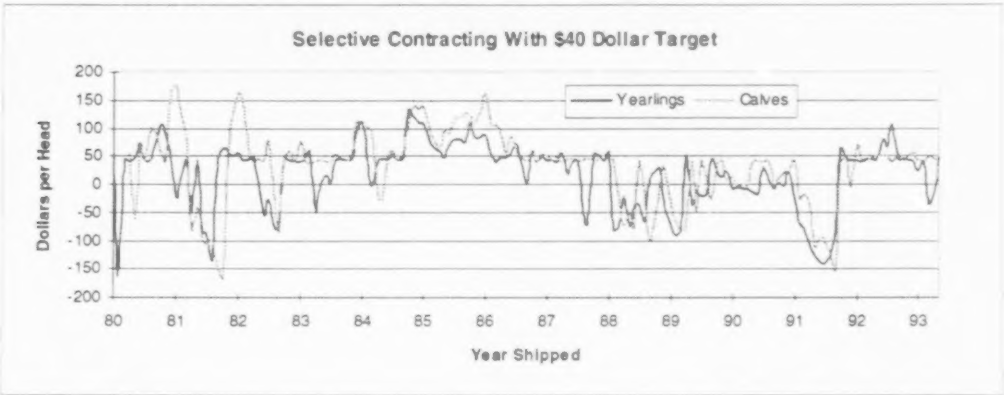
The selective contracting simulation purchases and finishes calves and yearlings in each month of the year as in the previous simulations. The hypothetical producer has the option of contracting the cattle to a US plant if the returns offered by the futures market and the cattle contracts reach a 40 dollar per head target return. The producer is allowed to contract the cattle from the day they are purchased up until 28 days before the cattle would be ready to be shipped to the US; the same day they would be sold on the domestic market.

If, during the allowable contracting period, the CME futures price offers the producer an after interest return of at least 40 dollars per head, the cattle are priced with the closing futures price of the day and contracted to the most profitable plant. If the target return is not reached, the cattle are sold on the Alberta cash market for the weekly average cash price.

The basis levels applied to the contracts are as described in Table 19 in Appendix B. The basis level will vary from pen to pen depending the time remaining from contracting day until the cattle are finished. Cattle being contracted late in the feeding period will receive a less favorable basis than those contracted early in the feeding period. The yearly number of pens contracted in each along with the average number of days into the feeding period before the pens are contracted is reported in Table 22 in Appendix B.

Figure 15 shows the returns per head after interest from using this strategy with both calves and yearlings. In contrast to the cash marketing results that were presented in Figure 6, this strategy shows a horizontal cut-off of returns around the 40 dollar per head level. In some cases, the pens showed returns in excess of 40 dollars per head due to the futures market offering a greater than 40 dollar return on the day the cattle are purchased.

Figure 15. Selective Contracting Returns With 40 Dollar Target



Although Figure 15 shows a number of 40 dollar per head returns, the strategy has not reduced the magnitude of negative returns from the cash marketing case. Pens which did not reach the target return realized the same cash market returns as the cash marketing strategy. Thus the potential benefits to this type of strategy occur when pens which would normally lose money on the cash market get locked in at a positive profit. Another down side of this strategy is the inability to capture potentially large profits which may be offered by both the cash and futures markets after the cattle have reached the 40 dollar target return. Table 7 summarizes the returns achieved by this strategy compared to cash marketing.

Table 7. Selective Contracting Average Annual Returns and Standard Deviations

Calves	% Change from Cash	Yearlings	% Change from Cash
17.48	14.77	16.27	-2.16
(13.76)	-25.46	(18.34)	-37.87
[-29.54]	0	[-39.49]	0

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

The annual return comparison in Table 7 shows that selective contracting has increased calf returns by 14.77 percent and decreased yearling returns by 2.16. The increase in average returns has coincided with a decrease in the level of return variability as represented by the declining standard deviations for both calves and yearlings. The calves received a 25.46 percent decrease in standard deviation while the yearlings received a 37.87 percent decrease. Although the return variation has been reduced, the minimum return levels have remained the same as with cash marketing.

Given that the selective contracting strategy has increased returns while decreasing return variability, the strategy may have value to some producers. However, the strategy provides limitations to potentially large individual pen returns and while providing no limitations on the magnitude of losses. Given these results, the 40 dollar target strategy will likely not be of great value to risk averse producers. The next section will incorporate a feed versus no-feed rule into the cash marketing model to see if the producer would have been better off by not feeding some of the cattle based on market information at the start of the feeding period.

5.6 Selective Cash Market Feeding

This section asks the question: What would have happened to the Alberta cash market returns had the cattle feeder chosen not to feed certain pens of cattle based on the futures market price and a simple basis prediction at the time the cattle were purchased?

The price prediction in the feed vs. no-feed decision was based on the closing futures market price on the day the cattle would have been purchased. The futures market prices were then converted to Canadian dollar value prices using the spot dollar. The Canadian dollar futures price was then adjusted with a forecasted basis.

The forecast price was then compared to a break-even price which was calculated using the starting feeder cattle price and production costs which are assumed to be known with certainty. If the predicted price was less than a target value, the cattle were not fed. Target values were chosen such that approximately 15 percent of the pens of cattle were not purchased.

The pen reduction of approximately 15 percent was arbitrarily chosen to illustrate the potential benefits or costs of this strategy. Some cattle feeders may feel that a 15 percent reduction in pens is unacceptable to their operations while other producers may be willing to cut back on additional pens if the ultimate result is an increase in net returns to their operations. To achieve this reduction in pens, after interest target returns of -30 and +30 dollars per head were used for yearlings and calves respectively.

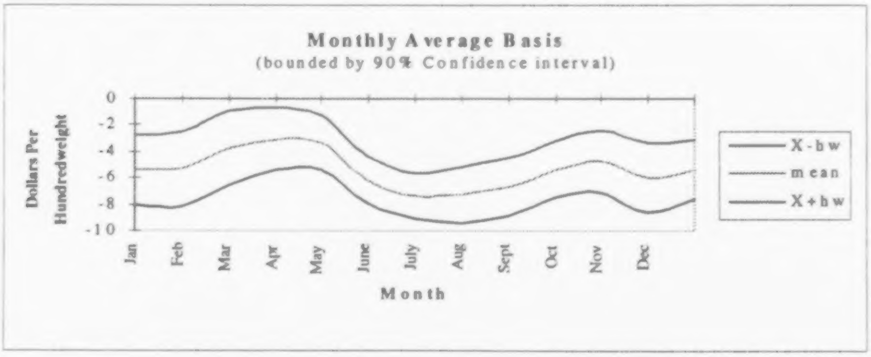
Although some pens of cattle did not get fed, the potential feeder cattle investment funds incurred the feedlot yardage costs as compensation to the operation for fixed and variable costs. The feeder cattle investment funds, less the yardage costs were then invested in 90 day T-bills for the duration of the feeding period. The returns from the T-bill investments were then included in the return series. The following sections outline the basis prediction that was used and the net results of this selective feeding strategy.

5.6.1 Basis Prediction

The basis forecast used in this simulation is an updated average of basis which relies on basis performance in the periods before the cattle were purchased. The first basis prediction for cattle purchased in January of 1980 was the observed nearby basis in January. The second and future basis predictions added the consecutive nearby basis levels to the average calculation, thus, the basis prediction for the final pen of cattle is the average of the nearby basis from 1980 to 1993. This forecast does not take the seasonal nature of basis into account.

The volatility and seasonality of basis is represented by the mean and 90 percent confidence interval around the mean basis levels as shown in Figure 16. From this figure it is apparent that there is a seasonal pattern to the basis when it is averaged by month from 1980 to 1993. Although season patterns exist when looking at the historical data, the confidence interval band in each of the months contains the average basis level from the whole time period. Thus, the expanding average basis predictions will fall within the 90 percent confidence interval in all months. Although the updated average prediction is feasible, it is likely not an optimal forecast for each pen due to seasonality.

Figure 16. Seasonal Basis Activity

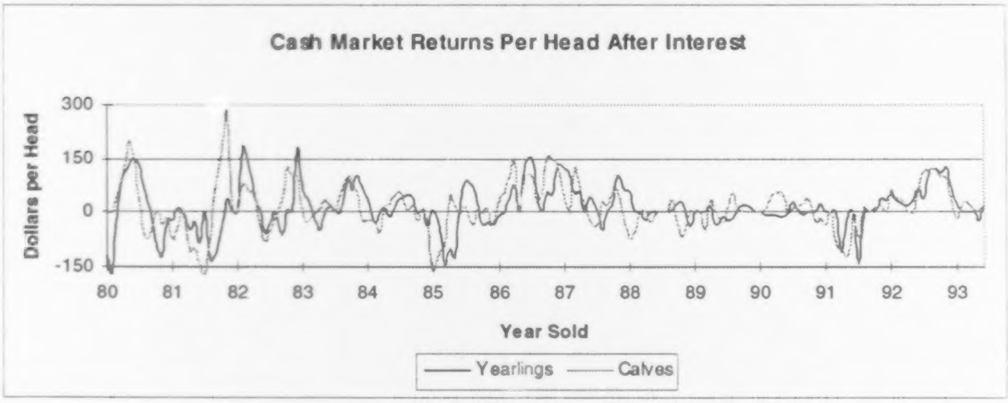


The seasonal basis patterns in Figure 16 may be useful in designing more accurate future basis forecasts, however, the seasonal pattern was not apparent early in the simulation. Thus, the simple updated average method of basis prediction was used in this simulation. The following section reports the results of the domestic feed versus no-feed simulation.

5.6.2 Selective Feeding Results

The results of the selective feeding simulations are shown as dollars per head after interest in Figure 17 and as percent annual return in Table 7. The results in Figure 17 show that the selective feeding program has not been successful in eliminating the large losses in 1981, 1985 and 1991. In all three time periods, losses reached the -150 dollar per head range.

Figure 17. Selective Feeding Results



From the results in Figure 17, it appears the selective feeding strategy has not been successful, however, the annual return results show a general improvement to the continuous feeding-cash marketing strategy. With the exception of a small reduction in calf returns, all of the descriptive statistics show an improvement over the continuous fed-cash marketing case. Table 8 contains a comparison of the statistics from this simulation and base cash marketing simulation.

Table 8. Selective Feeding Annual Returns

Calves	% Change from Cash	Yearlings	% Change from Cash
14.80	-2.82	18.67	12.27
(16.71)	-9.48	(22.35)	-24.29
[-24.05]	18.34	[-34.12]	13.60

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

The yearling returns showed the most dramatic improvement with returns increasing by 12.27 percent and standard deviation of returns decreasing by 24.29 percent. The minimum return was also raised by 13.60 percent, however, the minimum observed return of -34.12 percent is still a very large loss for many risk averse investors. The calf returns showed decreases in the mean and standard deviation of returns of -2.82 and -9.48 percent respectively. The minimum calf return was improved by 18.34 percent. The smaller magnitude of change compared to the yearlings could be due the relative inaccuracy of the futures market price or the basis forecast for the longer feeding duration.

It is possible that better price and basis predictions could improve the overall results of this simulation, however, the results are generally positive. The results show that the futures market prices and basis predictions can be used to influence feeder cattle investment decisions and can contribute to better overall investment performance. Thus a feed versus no-feed rule is included in the following simulation.

5.7 Selective Feeding and Contract Pricing (NF-MA Strategy)

This simulation incorporates some of the positive aspects of the previous simulations into one model. The model simulates returns from cattle feeding over the period from 1980 to 1993 with contracting to US packing plants using alternative feeding and pricing rules. The continuously fed Alberta cash marketing alternative is the strategy used for comparison. Before describing this strategy, a brief summary of the previous simulation results is presented. The results of the previous simulations provide the foundation for the design of the following NF-MA strategy.

5.7.1 Summary of Previous Results

The results of the previous routine contracting, selective contracting and basis contracting simulations have shown both return enhancement and risk reduction potential when compared to Alberta cash marketing. It has been shown that there is value in setting the basis at the start of the feeding period and locking in the price of the cattle at a later date using the futures market prices. The selective feeding strategy showed that there was value in using the futures market prices and basis predictions in making the feeder cattle investment decisions. The NF-MA strategy described in the following section draws upon the strengths of these strategies.

5.7.2 NF-MA Methodology

The NF-MA simulation results are generated from the contracting of cattle to the US packers using the basis available at the time the cattle were purchased as in the routine contracting case. As was the case in the basis contracting strategy, the finished cattle must be delivered to the US plants and un-priced cattle receive the closing futures market price on the day the cattle are shipped. This strategy attempts to improve on the pricing mechanism that was used in the 40 dollar target strategy to allow for higher returns while reducing return volatility and increasing minimum returns.

To increase the level of returns, the model used arbitrarily chosen target return levels of 80, 40 and 0 dollars per head after interest in each of three feeding phases. The feeding period was split in three phases consisting of the first 28 days ($80 target), the second 28 days ($40 target) and the remainder of the feeding period ($0 target). Any cattle not making the break-even price in the third phase were priced (price was locked-in) on the final day of the feeding period.

As well as the time period separation with alternative target prices, this simulation makes use of futures market price trends to aid in pricing decisions. The crossing of the 5 day moving average to below the 20 day moving average line gives the model the opportunity to lock in the futures price provided the appropriate target price is met. The model does not allow the price to be locked in while the market is in up-trend as defined by the two moving averages. However, there could be missed pricing opportunities in instances where the futures price makes a top and target price is met only briefly. Although pricing opportunities may be missed, experimentation with the model without moving averages and with different lengths of moving averages indicates that this is not the case.

The moving averages used in this simulation are the same averages that were shown in Figure 5 in Chapter 2. As was described in Chapter 2, the crossing of the 5 day moving average to below the 20 day average only provides a rough guide to the timing of pricing decisions. More sophisticated and effective technical trading decision rules may be developed to suit individual risk preferences, management styles and discipline levels. However, the point of this exercise is to measure the effectiveness a simple rule as a base for future refinement.

The feed vs. no-feed decision was also incorporated in this model to reduce the number of pens of cattle by approximately 15 percent. Using the basis levels as provided by the contracting agents and the futures market price on the first feeding day, a predicted return was calculated. When the predicted return did not meet the required return based on the break even projection, the individual pen was not fed. To achieve the 15 percent reduction in pens, a -50 dollar per head after interest target was used for yearlings and a 0 dollars per head target was used for calves. The differences between these required targets is likely due to cattle feeders bidding an additional risk premium into the price of feeder calves to account for the differences in production risk associated with increased morbidity, mortality and potential for feed price changes. Using these targets, 25 of 162 yearling pens were not fed with 22 of those pens initially losing money in the cash market scenario. Twenty two calf pens were not fed with 11 of the pens initially losing money on the Alberta cash market.

The target prices and decision rules were arbitrarily chosen in consultation with other cattle feeders and have not been 'optimized' to achieve any specific results. They were chosen with the objective of being consistent with some actual cattle feeding strategies. The target pricing rules are consistent with two cattle feeding risk attitudes which say: 'let's go for the big bucks but cover our back sides if the market looks bad' and 'never lock in a loss'.

5.7.3 Decision Rule Summary

As with the previous simulations , cattle purchase decisions are made every month and fed for time periods as specified for the US markets. The production and marketing decisions are made as follows;

Day 1 - If the predicted return is less than the break-even plus a target return: cattle are not purchased and a T-Bill investment is made. If the predicted return is sufficiently high, the cattle are purchased and the feeding period begins.

Day 1 to day 29 - If the futures market price offers an 80 dollar per head or greater after interest return and the 5 day moving average is below the 20 day moving average, the cattle are priced. If not, the cattle remain un-priced into the following 28 day period.

Day 29 to 56 - If the futures market price offers a 40 dollar per head or greater after interest return and the 5 day moving average is below the 20 day moving average, the cattle are priced. If not, the cattle remain un-priced into the following period.

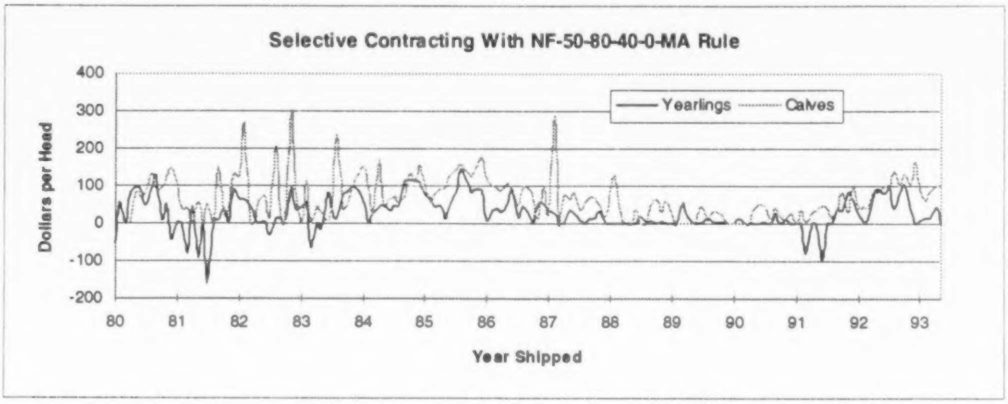
Day 57 to Finish - If the futures market price offers a 0 or greater dollar per head after interest return and the 5 day moving average is below the 20 day moving average, the cattle are priced. If not, the cattle remain un-priced until the final feeding day when they are shipped to a US plant.

5.7.4 NF-MA Results

The after interest per head return results of the NF-MA simulation are presented in Figure 18 and the annual return statistics are shown in Table 9. The results show a general increase in returns and decrease in risk with the strategy.

This strategy has been successful in reducing losses for both calves and yearlings with no calf pens receiving less than the break even level of return. The calves also experienced maximum per head returns of greater than 200 dollars on 5 occasions. The large calf cash market losses in 1981,1985 and 1991 were eliminated with this strategy.

Figure 18. NF-MA Returns Per Head After Interest



The yearling returns were also improved with the strategy. Losses in 1985 were eliminated while losses in 1981 and 1982 were reduced from the cash marketing strategy. As well, the strategy provided several 100 dollar per head returns over the time period. However, the upside potential for yearlings was reduced somewhat from the cash marketing strategy. Although the NF-MA strategy was generally successful, it only reduced the losses in 1991 from approximately -150 to -100 dollars per head.

The annual return statistics showed improvement over the cash marketing strategy with a larger advantage for calf feeding. Average calf returns increased by 65.79 percent with a reduction in standard deviation of 27.52 percent. Minimum returns were increased from -29.45 to +5.69 percent.

Table 9. NF-MA Annual Returns

Calves	% Change from Cash	Yearlings	% Change from Cash
25.25	65.79	19.46	17.02
(13.38)	-27.52	(12.87)	-34.08
[5.69]	+	[-20.16]	48.95

* The number in parenthesis is the standard deviation and the number in square braces is the minimum observed return.

Although the improvement for yearlings was not as large as it was for calves, the strategy did provide improvements of 17.02, 34.08, and 48.95 percent for the mean, standard deviation and minimum return levels. The less dramatic mean return result for yearlings is partly due to the shorter feeding period than for calves. With calves, the futures market had more time to come up to the target price levels. It is very likely that the target returns and the decisions rules can be changed to improve simulated yearling and calf returns.

The results show that it is possible to increase returns and decrease risk using cattle contracts, without the constraints associated with potential margin calls. The positive results are due to the ability to lock in the basis and use the futures market as a pricing mechanism along with the effects of a longer US feeding period.

Over-all the results have been very positive for the NF-MA simulation, however, it is only a computer simulation which adheres to strict decision rules. Market psychology and the political environment do not influence these decisions as they might influence actual investment decisions. It is also important to realize that these results, as with the previous contracting results, are dependent on the contracts being available to producers over the time period.

Although there may be some limitations to these results, the results do warrant further consideration and comparison. The analysis in the next section compares the risk and returns from all of the strategies that were simulated in this section.

5.8 Return Comparisons

The first part of this section compares some of the return distributions that were generated by the previous strategies. This section then examines the risk and returns from the strategies with a market based risk return comparison.

5.8.1 Return Distributions

This section presents the returns from the previous cash marketing, routine contracting and NF-MA simulations in histogram form. Figures 19 throughout 23 show the frequency of returns from cash marketing, routine contracting and NF-MA strategies for calves and yearlings with cash marketing as the base for comparison. The histograms for calves and yearlings suggest that the distribution of returns from the strategies are very similar for both types of animals, however, the different marketing strategies result in different shaped distributions.

The cash market returns have normal shaped distributions although the yearling distributions have slightly longer positive tails due to the occurrence of several large return pens. In comparison to the cash market distribution, the routine contracting distributions in Figures 19 and 21 are more heavily skewed to the right or positive side of the mean with fewer occurrences of low returns. This implies that routine contracting has contributed to increasing the probability of observing returns that are higher than the mean return.

The NF-MA histograms show patterns of returns which are more consistent with the objectives of some producers and investors. The short left tails indicate a lower probability of loss while the long right hand tails indicate the possibility of higher returns. The NF-MA histograms show the majority of the pens with positive returns. The most obvious difference is in the calf distributions located in Figures 21 and 22 where the number of 11 percent range pens has been decreased and the number of 31 and 41 percent return pens has increased substantially. The yearling returns are also highlighted by a general shift to the right with both routine and NF-MA contracting with the NF-MA strategy exhibiting a large number of 17 percent range returns. The return distributions are shown on the following page.

Figure 19. Yearling Cash vs. Routine Contracting Distributions

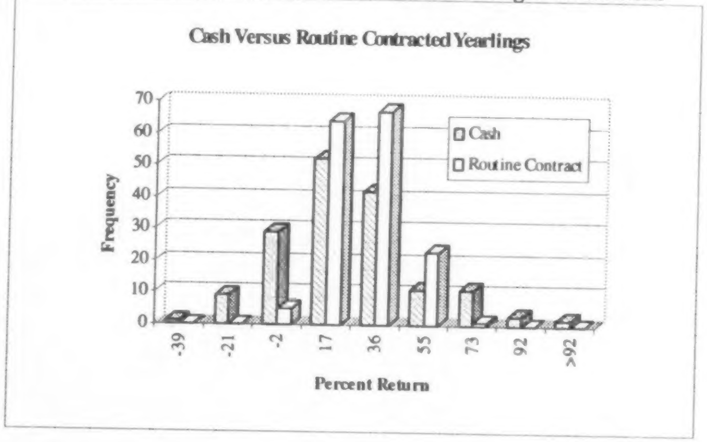


Figure 20. Yearling Cash vs. NF-MA Distributions

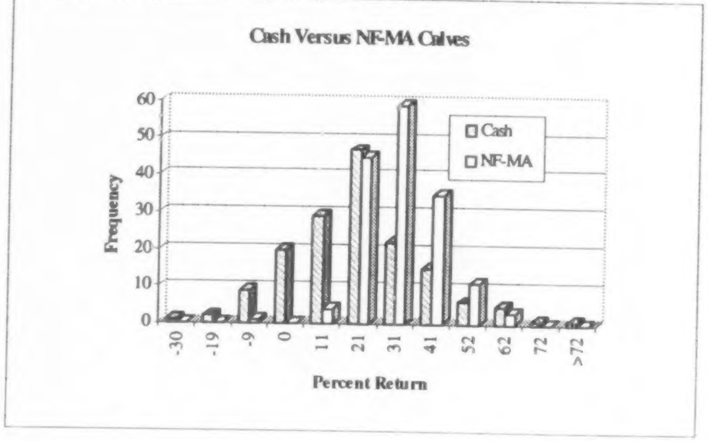
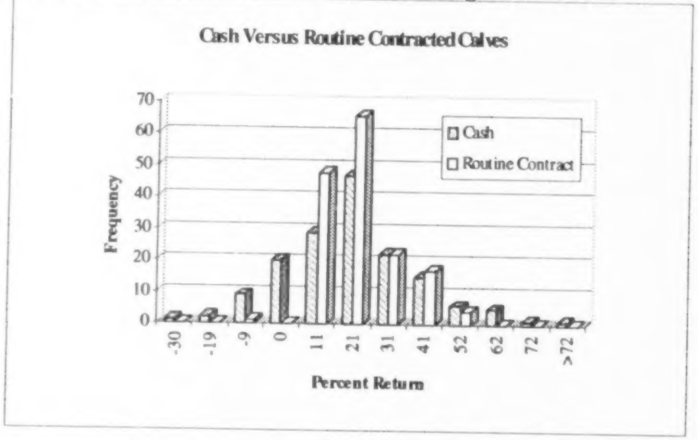
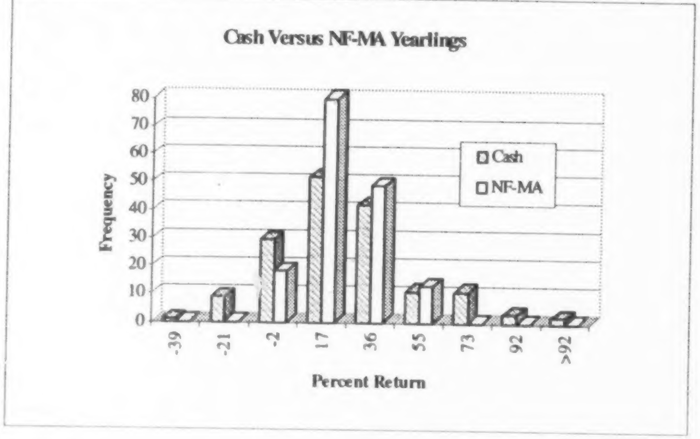


Figure 21. Calf Cash vs. Routine Contracting Distributions



F igure 22. Calf Cash vs. NF-MA Distributions



In general, the frequency distributions in Figures 19 to 21 imply that both routine and NF-MA contracting strategies have decreased the probability of losses. The distribution based on the NF-MA rule has frequency distributions that are consistent with lower risk-higher return investments. Both of the contracting strategies would likely be preferred by risk averse investors using the safety-first evaluation criterion. The next section examines the results of these simulated strategies in market based risk return comparison.

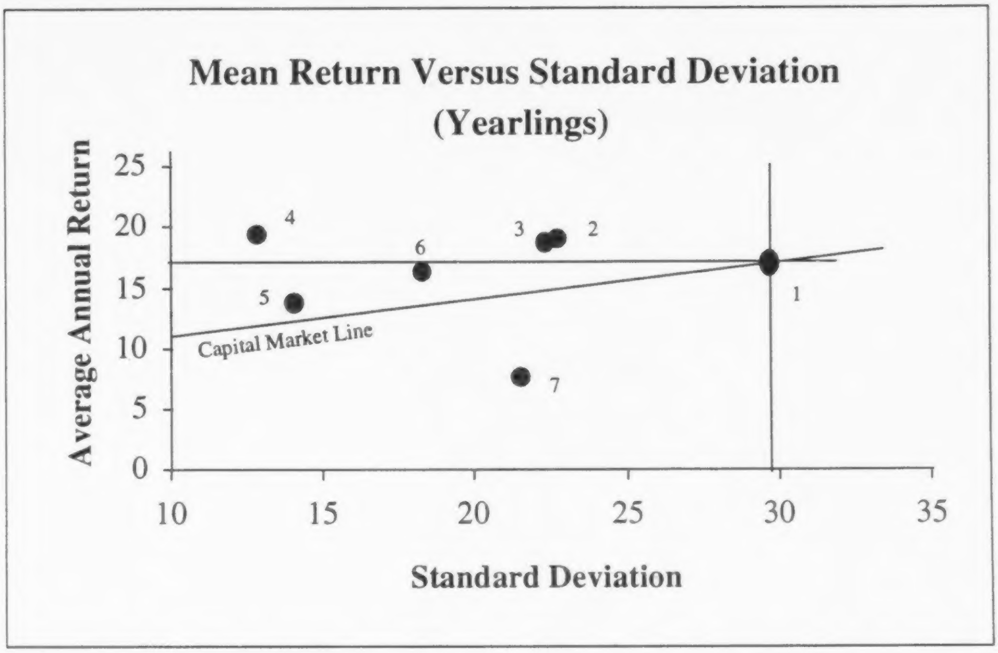
5.8.2 Market Based Risk-Return Comparison

This section compares the risk and returns from the marketing strategies from a financial market trade-off perspective with standard deviation representing the relative risk. Figures 23 and 24 show the mean annual returns plotted against the standard deviation of returns. The figures are divided into four quadrants with the base cash marketing return at the center for comparison. The figures are also bisected by the capital market line which intersects the cash marketing return.

Using the expected value - variance (E-V) criterion, any marketing alternative that is above and to the left of the cash marketing alternative will always be preferred by a risk averse investor. Alternatives below and to the right will be dominated by the cash marketing strategy. Alternatives in the upper right and lower left quadrants will not dominate, or be dominated by, the cash market alternative.

The slope of the capital market line in Figure 23 represents the approximate risk return trade-off present in financial markets. Thus, investment alternatives falling below the capital market line will not be preferred by risk averse investors because of the lower return with respect to the standard deviation or variance of the asset's returns. In this case, risk averse investors would find a better risk return trade-off by investing in a market portfolio of assets.

Figure 23.Yearling Return Comparisons

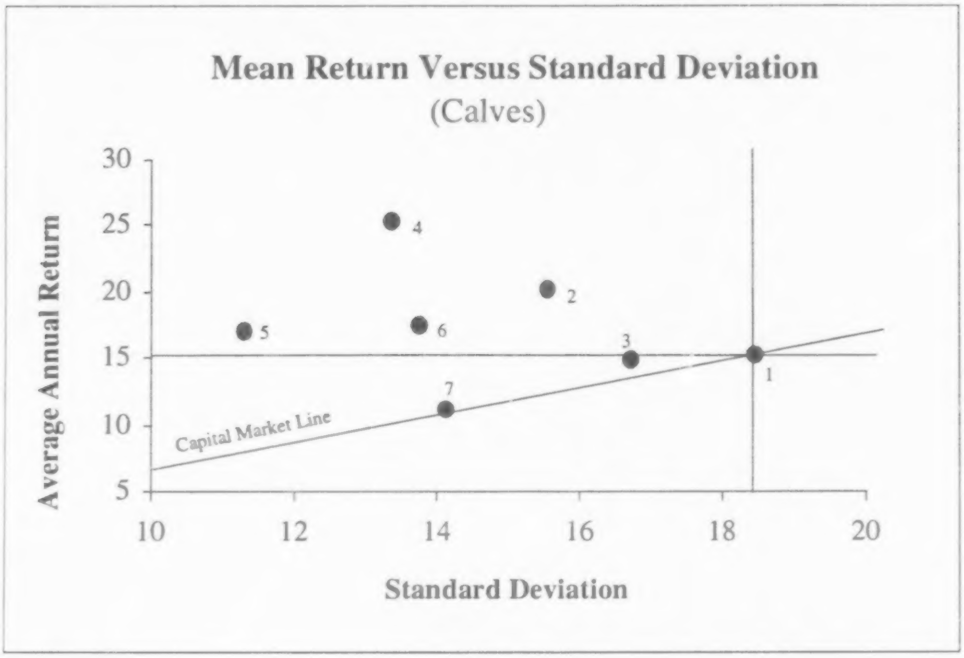


Strategies:

1. Cash Marketing
2. Basis Contracting to the US.
3. Selective Feeding to the Alberta cash market
4. NF-MA
5. Routine Contracting
6. Selective US Contracting with 40 dollar target
7. Routine Hedge

The yearling results in Figure 23 show that all of the marketing alternatives other than routine hedging have risk return trade-offs which are superior to cash marketing using the capital market line criterion. The returns provided by the NF-MA strategy are the most preferred since the strategy has the highest annual return and the lowest standard deviation or risk. The other four strategies exhibit risk-return trade-offs which are very similar among the group, however, the selective and routine contracting may not be preferred using the E-V criterion because the mean returns are lower than the cash market returns. However, they are preferred to cash marketing using the capital market line criterion.

Figure 24. Calf Return Comparisons



Strategies:

1. Cash Marketing
2. Basis Contracting to the US.
3. Selective Feeding to the Alberta cash market
4. NF-MA
5. Routine Contracting
6. Selective US Contracting with 40 dollar target
7. Routine Hedge

The calf feeding results in Figure 24 also show positive results for some of the strategies. From an E-V perspective, only the selective contracting and routine hedging strategies have the possibility of not being preferred to the cash marketing alternative. Of the four preferred strategies, the NF-MA and routine contracting strategies dominate using the capital market line slope as the decision criterion. Comparing the NF-MA strategy with routine contracting using the capital market line indicates that the NF-MA strategy would be preferred by risk averse investors provided that all other associated risks and costs are equal across strategies.

Although this analysis identifies the NF-MA strategy as the most preferred for both calves and yearlings, the analysis does not account for the transactions and management costs of using the strategy. However, the analysis does show that the there are some alternative production and marketing strategies that can provide producers with a better risk return trade-off given risk averse behavior. Table 23 in the appendix shows all of the recorded descriptive statistics for the 162 pens each of yearlings and calves.

5.9 Chapter 5 Summary

The results presented in this chapter have shown that there are risk management strategies that out-perform the traditional cash marketing strategy, both from a safety first and mean-variance perspective. The reduction of basis risk with routine and NF-MA contracting has resulted in rightward shifts and a semi-truncation of the left side of the return distributions. These distribution shifts are one step towards achieving the floor price or guaranteed margin type of return that was present with NTSP. The inclusion of the simple moving average rule has shown that although futures markets may be efficient, there are technical tools that can be used to increase hedging and contracting performance.

With the analysis of some basic strategies completed, this report now shifts to an examination of the inputs into the cattle production system. The discussion in the next chapter examines the relative costs and potential return changes from an input perspective. The WDFB contracts are examined as a input price reduction instrument. The chapter following the input discussion looks at the use of put options and Alberta contracting as possible market risk reduction tools.

CHAPTER 6 BARLEY PRICE RETURN EFFECTS

6.1 Introduction

With barley as the primary component of the rations used in the Alberta cattle feeding industry, it is important to examine the effects of price changes on cattle feeding returns. Since the distinction between strictly commercial cattle feeders and farmer-feeders is not always clear, barley price changes will affect cattle feeding operations in different ways. Cattle feeders view changes to feed prices as both positive and negative in terms of whole farm returns. Cattle feeders who purchase large quantities of barley are typically looking to secure supplies at the lowest possible price while some cattle feeders with large barley production capabilities are typically looking to maximize barley returns by feeding cattle.

Cattle feeders typically have both short and long term objectives when managing barley price risk as many cattle feeders use grazing and backgrounding programs in conjunction with their finishing operations. With light weight cattle being purchased from 6 to 10 months prior to finish, fattening costs are susceptible to interim barley price changes before the cattle reach the feedlot. Unexpected price movements can increase the riskiness of returns.

Another source of return risk or volatility results from changes in feed prices during the fattening period. Feeder cattle investment decisions are often made based on a particular pen's projected break-even level which includes the expected cost of gain. Unexpected changes in the cost of gain through barley price changes will affect the level of return for each pen. Thus, returns which vary from the projected levels contribute to increased investment risk. The analysis in the following sections examines the effects of barley price changes on cattle feeding returns and risk due to the within-period price changes.

Managing grain price changes is seen by some cattle feeders as an important aspect to improving a firm's overall competitiveness within the industry. Cattle feeders have the Western Domestic Feed Barley (WDFB) futures contract as a barley price risk management tool for both the short and long term cattle investment decisions. By using the WDFB contracts, cattle feeders can make anticipatory hedges to protect against barley price changes. When a cattle feeder feels that the price of barley will rise in the future, barley prices can be 'locked in' with futures contracts. However, the cattle feeder remains exposed to the possibility of lower barley prices and correspondingly higher feeder cattle prices at the time when the cattle are actually placed in the lot. The WDFB contracts often become active up to one year before maturity of the contract. Although the historical volume on the distant contract can be quite low with as few as one or two trades per week, the mechanism is in place to facilitate hedge transactions.

The analysis in this chapter attempts to achieve fixed barley pricing to managing short term barley price risk by using the WDFB contracts. The simulated cash market returns that were derived in Chapter 5 are further analyzed with respect to barley price changes. Returns from 1980 to 1993 are generated both with and without the effects of barley prices changes. The returns are then compared using the traditional mean-variance criteria. Following this analysis is an examination of the time period from late 1989 to 1993 when the WDFB contracts were available. The effectiveness of the WDFB contract in reducing within-period price risk is measured using the root mean square error and the traditional mean-variance statistics.

6.2 Relative Input Costs

Barley grain and barley silage are the primary sources of energy and fiber used in most Alberta feedlot rations and is the single largest input cost. A previous study (Boyd and Kaastra, 1994), suggested that barley accounted for 30 percent of total input costs per steer. However, the results from this cattle feeding model suggest that barley has accounted for an average of 51.24 and 57.46 percent of nominal inputs costs for yearlings and calves respectively over the period from 1980 to 1993. Although the barley cost is the largest single input cost, it is relatively small in comparison to the cost of the feeder animal. Barley as barley grain and silage accounts for 12.21 and 16.61 percent of the total expenses when the cost of the feeder steer is included. Table 10 shows the breakdown of average nominal expenses in this study's cash marketing simulations.

Table 10. Average Nominal Expenses

	Yearlings			Calves		
	$ / Hd	% of Total Inputs	% of Non-Cattle Inputs	$ / Hd	% of Total	% of Non-Cattle Inputs
Feeder	732.75	78.75%		621.04	67.57%	
Barley	104.72	11.25%	52.96%	135.95	14.79%	45.62%
Silage	8.89	0.96%	4.50%	16.74	1.82%	5.62%
Supplement	12.45	1.34%	6.30%	17.71	1.93%	5.94%
Bedding	2.4	0.26%	1.21%	17.2	1.87%	5.77%
Medicine	5.34	0.57%	2.70%	18.52	2.02%	6.21%
Feed Processing	13.16	1.41%	6.66%	17.2	1.87%	5.77%
Yardage	19.66	2.11%	9.94%	30.54	3.32%	10.25%
Interest	31.11	3.34%	15.73%	44.14	4.80%	14.81%

From the figures in Table 10 it is apparent that barley costs are important relative to other inputs but quite small in comparison to the feeder steer investment. Given the costs and returns of previous cash market simulations, the sensitivity of returns to changes in barley, feeder steer and fat steer prices were calculated. The sensitivity results for average real after interest per head returns and average annual returns were calculated with 1, 5 and 10 percent adverse price movements.

The results confirm that barley price changes have the smallest impact on net yearling returns with a 4.43 percentage point reduction in average annual returns from a 10 percent increase in barley prices over the time period from 1980 to 1993. In contrast to the barley impacts, a feeder price increase of 10 percent resulted in a reduction in annual returns of 24.12 percentage points and 10 percent lower fat price caused a reduction in annual return of 32.74 percentage points. The changes in returns were not as large for calves due to the longer calf feeding period and increased weight gain.

Table 11. Sensitivity Of Returns

		Yearlings		Calves	
	% Change	Per Head	Return Δ[1]	Per Head	Return Δ
Barley Price	0.01	-1.26	-0.001	-1.84	-0.40
	0.05	-5.95	-0.45	-7.92	-2.01
	0.10	-11.87	-4.43	-9.28	-3.96
Feeder Price	0.01	-12.98	-2.76	-6.13	-1.58
	0.05	-36.05	-12.99	-30.63	-7.60
	0.10	-71.99	-24.12	-61.25	-14.47
Fat Price	-0.01	-9.43	-3.60	-9.15	-2.34
	-0.05	-47.21	-17.28	-45.71	-11.48
	-0.10	-94.06	-32.74	-91.41	-22.35

[1] Return Δ is the change in return level.

Although the return effects of barley price changes is relatively small in comparison to feeder cattle and finished cattle price changes, potential barley price changes are large enough to warrant consideration by some cattle feeders. With average yearling returns of 6.90 dollars per head, a reduction of 11.87 dollars per head due to a 10 percent barley price increase can have a large total impact within the feeding period.

6.3 Historical Return Volatility Results

This section examines volatility of cash market cattle returns which were due to barley price changes. The analysis in the previous chapters relied on barley being priced at the weekly Red Deer street price throughout the simulated feeding periods. This analysis compares the previously generated returns to returns generated from grain pricing with the Red Deer street price at the beginning of the feeding period. In this case, barley costs are known with certainty at the beginning of the period, thus, the within-period barley price risk is removed.

All of the production parameters used in the previous chapters remain the same in this analysis with the exception of the barley prices. The feeding program in this section feeds yearlings 119 days before being sold on the Alberta cash market. Calves are fed for 182 days before being sold on the Alberta cash market

The results of the simulations show that barley price changes have actually contributed to a decrease in the volatility of returns. The volatility of within-period barley prices is affected by maximum price changes of +40.93 and -50.46 dollars per tonne for yearlings, and +51.18 and -56.54 dollars per tonne for calves. Table 12 shows the changes in returns per head after interest and Table 13 shows the annual return comparison as a result of the fixed barley prices.

Table 12. Per Head Returns With Fixed Barley Prices

	Calves	% Change from Floating	Yearlings	% Change from Floating
mean	12.25	4.97	6.86	-0.58
st.dev	78.24	6.26	75.70	1.83
minimum	-198.1	19.91	-163.5	1.20
maximum	286.73	1.21	326.2	0.08

The results in Table 12 show increases in standard deviation of 6.26 and 1.83 percent for calves and yearlings respectively. Thus, with setting the price of barley at the beginning of the feeding period, return volatility or risk has been increased somewhat. This result is also shown in Table 12 where the standard deviation of annual returns was increased by 4.87 percent and 0.03 percent for calves and yearlings respectively. Although the return volatility has increased somewhat, the increases are very small in the yearling simulation in comparison to the calves. This result is likely due to the longer calf feeding period.

Along with the increases in return volatility are lower minimum observed return levels for both yearlings and calves. Minimum returns were lowered by 19.91 percent for calves and 1.20 percent for yearlings. These minimum returns are consistent with the lower minimum annual returns in Table 13.

Although minimum returns and standard deviation of returns have been adversely affected by eliminating barley price changes, the mean returns have not been greatly affected by the strategy. Calf annual returns were increased by 0.07 percent while yearling returns decreased by 0.48 percent.

Table 13. Annual Return Comparison

	Calves	% Change from Floating	Yearlings	% Change from Floating
mean	15.24	0.07	16.55	-0.48
st.dev	19.36	4.87	29.62	0.03
Minimum	-32.4	-9.68	-40.97	-3.75
maximum	93.6	1.63	186.9	0.27

The changes in standard deviation as shown in Tables 12. and 13. are somewhat counter intuitive since volatile grain prices would normally be thought of as a contributor to more volatile returns. An examination of the correlation coefficients between the barley prices and the fat cattle price gives an indication as to one possible reason for the unexpected results. The correlation coefficient for the original calf simulation with 'floating' barley prices and the Alberta Direct slaughter cattle price is -0.32729 while using the barley price set at the beginning, the correlation coefficient was -0.39091. The larger negative correlation coefficient indicates a stronger negative correlation with set prices, thus, barley price changes have been coincidental with larger opposite cattle price changes which is reflected in greater return volatility.

To test the hypothesis of differing barley and fat cattle price correlation, simulations were run with the price of finished cattle known with certainty at the beginning of the feeding period. The results showed that returns generated from the fixed barley prices continued to exhibit higher variability than those with floating barley prices. Given that all of the other costs were the same with both the fixed and floating barley price simulations, the difference in results is due to the averaging effect of the floating barley prices. The floating barley price smoothes the feed costs so that no one pen of cattle gets charged an extremely high or low barley price for the duration of the feeding period.

The results in this section indicate that routinely locking in the barley price at the start of the feeding period does not reduce the overall return risk as measured by the standard deviation of returns. Thus, controlling barley prices may not the best strategy for all pens of cattle.

Although return risk has not been reduced by eliminating the effects of barley price changes as measured by standard deviation, the level of within feeding period risk as measured by the root mean square error may actually be reduced. The analysis in the following section examines the return effects of using the Western Barley futures contract in comparison with the floating price model.

6. 4 tern Barley Futures Results

The results in this section were obtained from routinely using long WDFB contracts to hedge the barley supply prices upon placement of the cattle. The simulation begins with the WDFB contract applicable to cattle purchased in June of 1989 and runs through to the end of 1993. The objective of this strategy is to maintain a net barley cost which is as close as possible to the price at the beginning of the feeding period.

With this strategy, WDFB futures contracts are purchased at the beginning of the feeding period and are offset in each week of the feeding. Per tonne returns from the futures transactions are combined with the floating barley price returns to form a new net return which is compared with the base scenario which uses the floating cash market prices in generating returns.

In this simulation, risk is measured by both standard deviation of returns and root mean square error (RMSE). The RMSE measurement uses the returns based on the cash market barley price on the first feeding day as the predicted returns. Thus, the futures price and basis predictions are based on the observed levels at the start of the feeding period. The results in Table 14 show small increases in standard deviation and RMSE for both calves and yearlings. Thus, the results of this simulation suggest that the WDFB contracts have limited value in reducing within-period return risk.

Table 14. WDFB Annual Returns Comparison

	Calves		**Yearlings**	
	WDFB	Floating	WDFB	Floating
mean	4.46	13.44	2.27	12.66
st.dev	19.1	16.87	28.8	27.31
RMSE	11.08	3.65	12.6	2.19
minimum	-39.5	-29.5	-50.5	-40.97
maximum	45.4	44.47	71.9	71.79

Use of the WDFB futures has contributed to increased levels of return risk when measured with the RMSE measurement and the standard deviation measurement. As well, mean annual return levels have been reduced from 13.44 to 4.46 percent for calves and 12.66 to 2.27 percent for yearlings. The range of returns has also been increased with the WDFB contracts as shown by the calf range expanding from [-29.5,44.7] to [-39.5,45.4] percent. The yearlings experience a range expansion of a slightly smaller magnitude with the maximum returns staying at approximately the same level.

The lack of WDFB futures effectiveness is due to variability of basis levels within the feeding period. Given that all other parameters remained constant, the difference in returns from the fixed price scenario is due to changes in basis from the level at the beginning of the feeding period. The variability of the barley basis and the less than perfect hedging effectiveness is also captured in the correlation coefficient for the cash and futures market prices and a maximum observed basis level of 40.41 dollars per head. The imperfect correlation is captured in the correlation coefficient which was calculated to be 0.8757. A less than perfect hedge is the result.

The use of the WDFB contracts for within period barley price control has resulted in lower returns and increased return risk which is consistent with the results in the previous section. The WDFB contracts have been quite expensive in terms of return reduction, however, the contract does have value to many producers in securing barley supplies. The supply benefits may be substantial in periods of tight supply.

6.5 Results Summary

The results in section 6.2 showed that feed barley combined with barley silage has made up over 50 percent of the total non-cattle input costs for both yearlings and calves over the period from 1980 to 1993. Relative to average nominal feeder cattle expenditures, the cost of barley is quite small. The proportion of total expenditures on barley and silage was 12.22 and 16.61 percent for yearlings and calves respectively. Thus, it was suggested that barley price changes may not have a large effect on net returns to cattle feeding.

The impacts of barley price changes on net returns were compared to the impacts of changes in the nominal feeder cattle and fat cattle prices. The return effects from barley price changes are very small in comparison to the cattle prices. The results show that a one percent increase in the price of barley had virtually no effect on yearling returns while a one percent increase in feeder cattle prices reduced annual returns to a level 2.76 percentage points below the initial level. A one percent decrease in the fat price reduced average yearling returns by 3.6 percentage points. These statistics support a typical cattle feeder's opinion which suggests that 'in the big picture, barley price risk reduction is not all that important.'

Although price variation may not be a big concern to some producers, there can be no doubt that there is value in limiting the potentially large adverse price movements. As shown in Table 10, a 10 percent increase in barley prices has caused yearling annual returns to go down 11.87 percentage points. Given that the initial return was 16.63 percent, a reduction to 4.76 percent return is likely not acceptable to most producers. Thus hedging strategies may be of value.

The analysis in section 6.3 examined the return effects of 'locking in the price of barley at the cash market price on the day the cattle were purchased. Although there was likely no instrument to achieve this objective throughout the time period, the relative variability of barley prices and the effects of that variability on net returns are of importance. The results in Tables 11 and 12 indicate that setting the barley price at the beginning of the feeding period actually increases return risk a small amount. The standard deviation of returns were increased 4.87 percent for calves and 0.03 percent for yearlings.

These small increases in return variability are due to the averaging effect of barley priced throughout the feeding period. By setting the price at the beginning of the feeding period, investors may be locked into relatively high or low prices which do not change. Thus, increases in return volatility are likely.

The results in section 6.4 showed that the WDFB futures contracts were not successful in reducing return volatility and risk as measured by standard deviation and RMSE. The standard deviation statistics are consistent with those in the previous section which suggested that locking in the barley price may not be an optimal strategy. Given the maximum barley basis of 40.41 dollars per head and imperfect negative correlation, an increase in the RMSE statistics can be attributed to the volatility of basis during the feeding period.

The results in this chapter do not show return risk reduction from using the WDFB contracts for barley price risk management, however, it was shown that that large barley price changes can have a large effect on returns. The WDFB futures contracts have potential value by giving producers the opportunity to gain a competitive advantage over other firms by placing anticipatory hedges on future barley supplies. Custom feeding cattle operations can also use the contract when guaranteeing maximum feed costs for customers. Although the correlation between cash market prices and the futures market price is not perfectly negative it is quit strong, thus, the WDFB contracts can still provide protection against large adverse barley price moves.

The physical supply component of the WDFB futures also had value to some of the interviewed producers. However, with recent changes in the contract settlement and delivery system, these advantages may be reduced. The change in the delivery system may also change basis levels and basis variability if contract position holders become reluctant to hold open positions until contract expiry.

Although the results of this study are not positive for the use of the WDFB contracts in reducing return risk, the analysis suffers from a severe lack of data. Given that the contracts are very new, the simulation results are not strong and should not be used to discourage use of the futures contracts.

The results of this chapter have shown that barley costs are a large part of the non-cattle production costs and the WDFB futures can be used to offset large price movements. However, barley price changes result in small return effects in comparison to feeder and slaughter cattle price change return effects. Thus, the options case study in the next chapter will further investigate potential cattle price risk reduction tools and the components of cattle price related of return risk.

CHAPTER 7 OPTIONS CASE STUDY

The hedging simulations in Chapter 5 indicated that futures market hedges did not provide an effective floor price for cattle while the hedger was left exposed to potential margin calls. The use of forward contracts increased mean returns while reducing risk, however, the potential for large returns was reduced with simple target pricing strategies. The NF-MA strategy provided increased returns and fewer large losses with the use of a more management intensive pricing system. Given that put options can potentially generate a floor price without margin requirements and complex pricing strategies, this chapter simulates the routine use of long put options. The options are used in conjunction with traditional cash marketing and contracting strategies. This chapter also introduces the concept of an Alberta production contract into the analysis. The NF-MA results from 1987 to 1993 are presented along with the traditional cash marketing results as base for comparing options strategies. The primary objective of the case study is to determine the value of the put options in terms of their potential for reducing large losses similar to those observed in 1991.

The statistics used for comparing the various marketing strategies are; minimum returns, maximum returns, mean returns, standard deviation, root mean square error, number of pens with returns less than -80 dollars per head, number of pens with returns less than -40 dollars per head and the number of pens with returns greater than 40 dollars per head. All of the per head returns are presented as in real (1986=100) levels after interest costs have been deducted. The put options will be used in conjunction with three alternative marketing strategies which incorporate different pricing strategies and feeding periods.

7.1 Simulation Methodology

The historical simulation model used in this study calculates the returns to cattle feeding in a representative Alberta feedlot situation over the years from 1987 to 1993. Returns from routine put option hedging are combined with cash market returns, selective US contracting returns and returns from selective pricing of domestically contracted cattle.

The simulation model uses daily closing futures market and options settlement prices to evaluate hedging opportunities for each pen of cattle purchased. Pens of 800 pound feeder cattle are purchased in third week of each month and fed for 119 days for the Canadian market and 147 days for the US market. The cattle finishing weight is 1203 pounds for the domestic market and 1298 pounds for the export market. The simulated feeding and marketing of 650 pound calves is not included in this chapter, however, the NF-MA results for calves from 1987 to 1993 are presented in Table 23 in Appendix B. The specific production and marketing parameters used in the model were presented in section 5.1.

In order to formulate a representative forecast return to be used in the root mean square error calculation, a routine Alberta contracting simulation was generated. This strategy generated a forecast return based on the hypothetical contracting, of cattle to an Alberta packer on the day the cattle are purchased. The basis is assumed to be the updated mean of basis which includes the basis in the previous time period. As discussed in section 5.8.1, this basis prediction is feasible but likely not optimal. The price prediction is the exchange rate adjusted closing futures market price on the day the cattle are purchased. Thus, the forecast of returns is based on the fundamental cattle supply and demand information contained in the futures market price of the day. The return forecast assumes that all of the production costs are known with certainty.

Extending from the routine contracting and target price formulation is a selective Alberta contract pricing strategy. This is a basis contracting strategy with the basis determined using the updated average level at the beginning of the feeding period as was used in the return predictions. With this strategy, cattle are priced using the CME futures contract prices when the 40 dollar target return is attained. In the event that the target price is not attained, the cattle are priced using the CME futures price on the day the cattle are delivered to the Alberta packer. This strategy removes basis risk from the simulated contract returns, thus, the effects of the basis and other price changes can be observed more readily.

The US selective contracting alternative involves checking for a futures price which will provide the feeder with a target profit of 40 dollars per head after interest. As with the Alberta contracting strategy, this simulation involves setting the basis at the beginning of the feeding period, however, the basis used in this simulation is the basis which was provided by the contracting agents. The cattle are priced using the day's closing CME futures market price if the futures price offers the producer the 40 dollar per head target return. If the futures market does not offer the required profit before the US finishing date, the cattle are priced on the final day in the US feeding program. Thus, this strategy parallels the Alberta contracting so that comparisons between potential domestic and export returns can be made.

The options simulation involves purchasing (going long) an out-of-the-money put option at the time the cattle are purchased. The option is then sold at the time when the cattle are contracted or sold on the cash market. The strategy involves the purchase of a put option which is close to being at the money at the start of the feeding period. Returns from the options trading strategy are then combined with returns from the base marketing alternatives so that the joint results can be observed.

Since options trading on the live cattle futures contract closes on the first Friday of the contract's delivery month, the cattle were hedged with an option on the futures contract which has an open option contract on the day that cattle would be deliverable to the domestic cash market. For example, a pen of cattle that is due to be shipped domestically on the 15th of April would be hedged using an option on the June futures contract. This strategy eliminates the necessity for exercising the option, rolling the option in to the next contract month or allowing the cattle to go un-hedged near the end of the feeding period. With this strategy, there will normally be some time value remaining in the option at the end of the feeding period. With some of the US fed pens of cattle, option contracts with later expiry months are used. It may be argued that this is not always the best contract month or option strategy to chose, however, this strategy is relatively simple to manage and provides a reasonable approximation of the relative changes in option values.

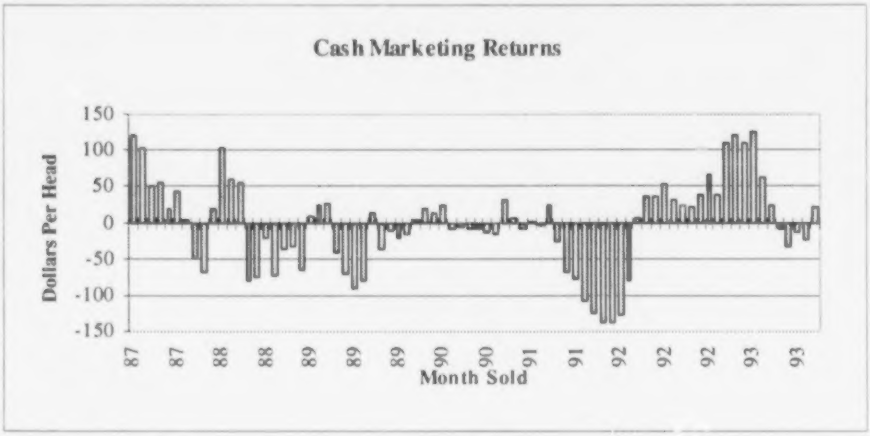
7.2 Simulation Results

Since most cattle feeders can easily relate to profits in terms of dollars per head, the results are generally presented as such. In all of the per head returns, interest has been charged to the cattle and feed investments at the appropriate 90 day t-bill rate plus 2%. All US dollar options and contracting returns were converted to Canadian dollar returns using the spot dollar on the day the cattle were sold. In addition to the per head returns, section 7.3 presents a comparison of annual returns from the cattle feeding simulations in a mean-variance format.

7.2.1 Cash Marketing Results

To establish a bench mark for the alternative marketing strategies, the cash market simulation results shown in Figure 6 were generated for the time period of the options simulation. The results of the cash market simulation are shown in Figure 25 and the summary statistics are located in Tables 15 and 16.

Figure 25. Cash Market Returns



Of the 79 simulated pens of cattle between 1987 and 1993, the cash marketing strategy resulted in 8 pens with returns of less than -80 dollars per head. From 1991 to 1992 there were 8 consecutive pens with losses greater than 50 dollars per head and 18 pens with returns less than -40 dollars per head. The minimum and maximum returns were -130.59 and 66.36 dollars per head respectively. The average return was - 2.32 dollars per head over the time period. The standard deviation of returns 61.33 dollars per head while the root mean square error (RMSE) was 59.27 dollars per head. These are the base statistics that will be used for comparing the results of the following simulations.

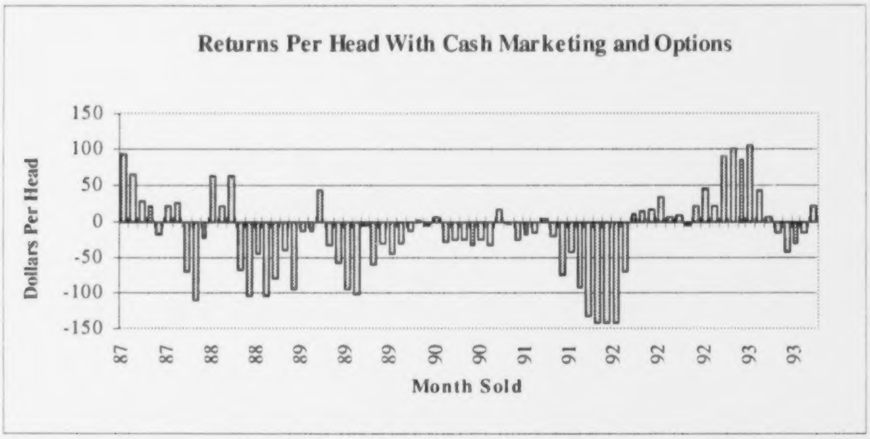
The statistics presented in the previous paragraph are of importance to cattle feeders and feeder cattle investors from a safety-first perspective . The magnitude of losses are important as some cattle feeding operations may not have the financial strength or equity to withstand large feeding losses that are sustained over a long period of time. Feeding losses in the 40 to 50 dollar per head range may not be unacceptable to some producers if they assume that positive returns are likely in the near future. However, losses of more than 40 dollars and losses that are sustained over a long period of time can have severe effects on investor equity. Thus, minimizing or eliminating the number of pens with losses of more than 40 dollars per head is a focus of the following options and alternative marketing strategies.

7.2.2 Cash Marketing With Options

In an effort to reduce the size and duration of the larger cattle feeding losses, returns from routinely purchasing and later selling an out-of-the-money put option were combined with the Alberta cash marketing results generated in the previous section. The net results of this joint strategy are shown in Figure 26.

In theory, positive returns from the put options should correspond to negative cattle price movements, thus, a floor price should be observed. However, the results show that the American put options transactions have not changed the overall structure of returns during the time period. The joint cash marketing and put options strategy has generated eight pens with returns less than -80 dollars per head. From 1991 to 1992 there were nine consecutive pens with losses where seven pens received returns that were less than -50 dollars per head. This not a large benefit given that there were eight 50 dollar or greater loss pens with cash marketing.

Figure 26. Cash Marketing Combined With Put Options



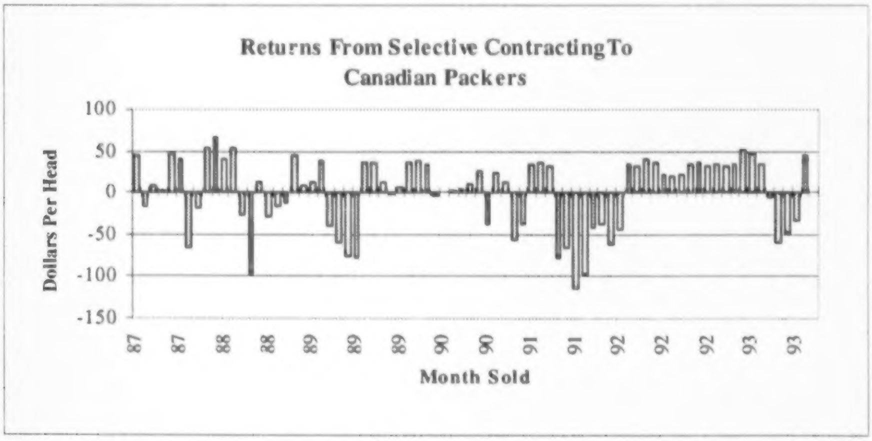
There were 22 pens with losses of greater than 40 dollars per head compared to only 18 pens with cash marketing. The maximum and minimum returns were 100.97 and -141.57 dollars per head respectively as compared with 124.66 and -138.58 dollars per head with cash marketing. The average return was reduced from - 2.32 to -15.84 dollars per head with put options included. The standard deviation of returns was decreased from 61.33 to 51.98 dollars per head while the root mean square error was reduced from 57.28 to 49.81. The simple options program appears to have not improved the return structure but has actually contributed to the severity of losses during the period. The strategy has resulted in improved standard deviation and RMSE statistics, thus, there has been some potential benefit. The next sections examine Alberta contracting strategies and the use of put options as part of those strategies.

7.2.3 Selective Contract Pricing to Alberta Plants

This simulation uses a selective contracting strategy with a 40 dollar per head target as was described in section 7.1. The simulation examines the results from contracting cattle to Alberta packing plants, had the contracts been widely available during the time period. This strategy applies feasible basis levels to the contracts but without actual historical basis information, the simulated contracts are very subjective.

The selective Alberta contracting strategy has raised the minimum and average returns but the maximum returns were also reduced in comparison to the cash marketing scenario. Mean returns were 1.05 dollars per compared to -2.32 dollars in the cash marketing scenario. The standard deviation of returns was decreased from 61.33 to 43.39 dollars per head while the root mean square error was reduced from 57.27 to 47.76. The reduction in variability as measured by the standard deviation and RMSE generally indicates a lower level of return risk. Figure 27 shows the results of this simulation.

Figure 27. Selective Alberta Contract Pricing Returns



As shown by Figure 27, selective contracting has reduced many of the large cash market returns while eliminating some of the cash market losses over the feeding period. Compared to cash marketing, selective contracting to Alberta plants has reduced the number of less than -40 dollar per head losses from 18 down to 15 pens. The magnitude of the large losses was also reduced as the minimum returns were increased from -138.58 to -114.63 dollars per head. The number of pens with returns less than -80 dollars was decreased from 8 to 3 while the number of pens with returns greater than 40 dollars per head was reduced from 15 to 11.

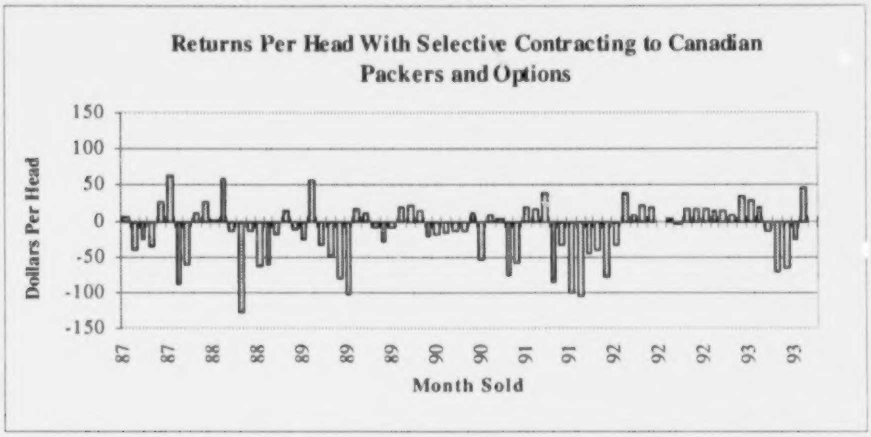
One result of this simulation is found by observing the magnitude of losses in 1991. Comparing these losses with the cash market losses from the same time period gives an initial indication of the basis changes which occurred during the time period. The basis in this contracting strategy was set at the beginning of the feeding period with futures market pricing when the market provided the 40 dollar target return or on the final feeding day if the futures market did not provide the target return. During 1991, cattle were not priced until the final feeding day with the cash marketed cattle experiencing the same day's Alberta cash price. Thus, the change in returns during this period can be attributed to changes in the Canadian dollar value of the Alberta basis.

In general, the selective Alberta contracts have improved the cattle feeding returns in terms of magnitude of losses in comparison to the cash marketing case. However, as shown by the reduced number of pens with returns over 40 dollars per head, the upside return potential has also been reduced. The net result was to tighten up the distribution of returns and slightly increase the mean returns. The simulation in the following section includes the routine use of put options in conjunction with this Alberta contracting strategy.

7.2.4 Selective Contract Pricing And Put Options

The results shown in Figure 28 represent the combined returns from the selective Alberta contracting of cattle along with routine put option trading. Returns from purchasing, and later selling, an out-of-the-money put option were combined with the contracting results that were generated in the previous section. This strategy has reduced the potential for large losses in comparison with the cash marketing strategy, however, the upside potential has been severely reduced. The use of options has improved the return variation statistics while reducing the mean returns compared to Alberta contracting as a single marketing strategy.

Figure 28. Selective Contract Pricing And Options



The joint Alberta contracting and put options strategy has reduced the number of pens with returns of less than -80 dollars per head to 6 from 8 with cash marketing. From 1991 to 1992, the observed losses varied in the -40 to -100 dollars per head range as compared to -100 to -140 with cash marketing. Thus, this strategy appears to be better than the cash marketing case. However, there were 20 pens with losses greater than 40 dollars per head compared to 18 pens with cash marketing and 15 with contracting alone. Thus, the magnitude of possible losses has not been reduced with this strategy.

The range of returns is better than the cash market case but worse than with contracting alone. The range of returns as bounded by the minimum and maximum returns of -127.57 and 62.24 dollars per head is compared with -138.59 and 124.63 dollars per head with cash marketing and -114.66 and 66.36 with Alberta contracting. The average return was also reduced from 1.05 to -14.64 dollars per head when put options included. The standard deviation of returns was decreased to 41.81 from 61.33 with cash marketing and 43.39 with Alberta contracting. The RMSE statistic was reduced to 35.64 from 59.27 and 47.76. Thus, the inclusion of options has stabilized returns at the cost of reduced returns.

In general, this strategy has been helpful in limiting the magnitude of losses which were observed throughout the time period with both the cash marketing and selective Alberta contracting strategies. However, this success has been at the expense of reduced mean returns which have gone to -14.64 dollars per head from -2.32 and 1.05 dollars per head in the cash marketing and Alberta contracting simulations (Table 15). As well, the number of pens with returns greater than 40 dollars per head has been decreased to only four from 15 and 11 in the cash marketing and Alberta contracting simulations.

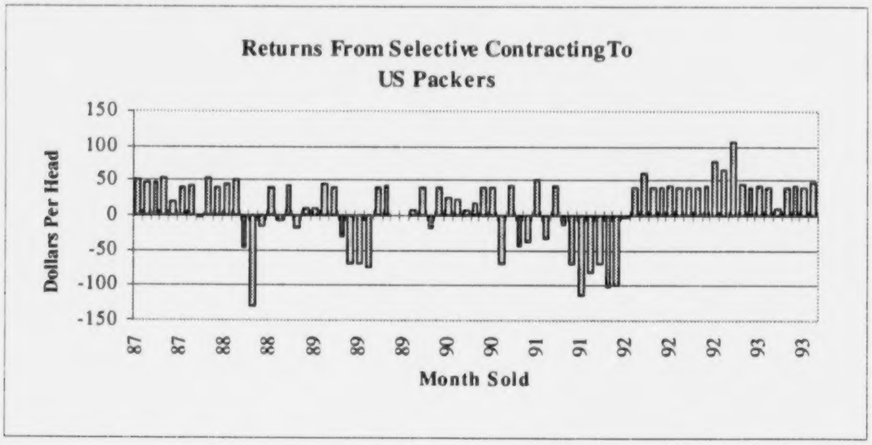
Given that the mean returns and upside potential has been reduced, it is unlikely that this strategy would be accepted by cattle feeders. However, the simulation does show some value for put options in reducing the magnitude of some of the losses and the variability of returns. The analysis in the following section will compare US selective contracting results to the cash marketing and Alberta contracting results

7.2.5 Selective Contracting to US Plants

One objective of this simulation is to compare the potential benefits from the US contract basis levels and the longer US feeding period to Alberta marketing strategies. With this US contracting strategy, the basis is set at the beginning of the feeding period and the cattle are priced when the target return is reached, as was the case with the Alberta contracting strategy. Cattle that do not achieve the target return are priced on the final day of the feeding period using the CME futures price.

The results show that contracting to US packing plants has limited the upside return potential to the 40 dollar per head target range while not affecting the severity of losses from the cash marketing and Alberta contracting strategies. These results show a similar pattern to the Alberta contracting results in section 7.2.2, however, the longer feeding and pricing period has allowed more pens to reach the target return. The selective US contracting results are shown in Figure 29.

Figure 29. Selective Contracting to the US



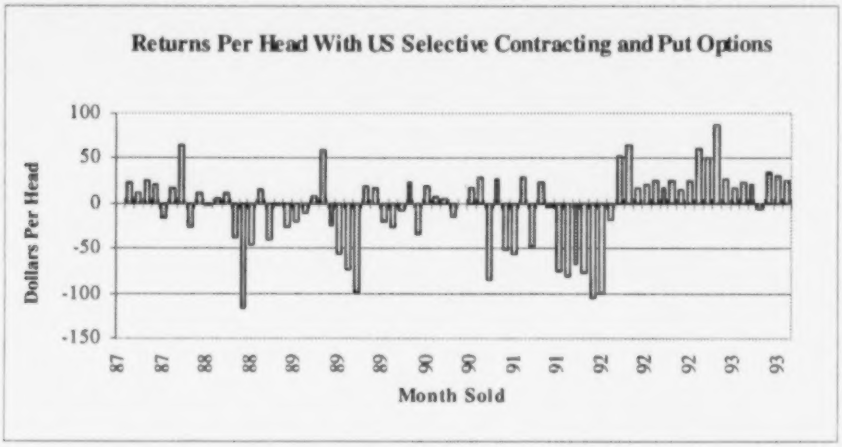
As shown by Figure 29, selective contracting has reduced many of the large cash market returns while eliminating some of the cash market losses over the feeding period. Compared to cash marketing, The selective US contracting strategy has reduced the number of less than -40 dollar per head losses to 13 pens from 18 and 15 with cash marketing and Alberta contracting respectively. The number of pens with returns greater than 40 dollars per head was greatly increased to 41 from 15 and 11 with cash marketing and Alberta contracting. However, this result is a function of the 40 dollar per head target price level. Many of the pens with greater than 40 dollar per head returns are in the range from 40 to 50 dollars per head. The average returns were also increased to 11.74 from -2.32 and 1.05 dollars per head. However, the standard deviation of returns was increased to 49.56 from 43.39 with Alberta contracting.

The US contracting results show a general improvement in mean returns over the cash marketing and Alberta contracting strategies however, the variability of returns was increased from the Alberta contracting strategy. Of primary concern is the magnitude of losses which is highlighted by the 13 pens with returns less than -40 dollars per head. The simulation in the following sections will attempt to address this concern by using a put option along with the US contracting strategy.

7.2.6 Selective Contracting to US Plants Plus Options

The inclusion of put options with the selective contracting to the US has also failed to reduce the number and magnitude of large losses when compared to the base simulations. The alternative option contract months and longer feeding period has produced higher but more variable returns than Alberta contracting with options strategy. The use of options has been increased the number of negative returns from 1988 to 1992. Figure 30 shows the results of the joint strategy.

Figure 30. Selective US Contracting and Options



As shown in Figure 30, selective contracting has reduced many of the large cash market returns while eliminating very few of the cash market losses over the feeding period. Compared to cash marketing, selective contracting to US plants along with put options has only decreased the number of less than -40 dollar per head losses from 18 to 16 pens while the use of the US contracting strategy alone reduced the number from 18 to 13. The number of pens with returns greater than 40 dollars per head was severely reduced from 15 to 8 with US contracting and options. The average returns were -3.83 dollars per head compared to -2.32 with cash marketing and 11.74 with the US contracting alone. However, the standard deviation of returns was decreased to 43.98 from 61.33 and 49.56 dollars per head while the root mean square error was reduced to 48.70 from 59.27 and 62.36 with the cash market and US contracting strategies respectively.

The inclusion of options with the US contracting strategy has produced results which are consistent with the general direction of the Alberta contracting and options results. That is, the use of options has not reduced the potentially large losses that were present in the cash marketing and other base strategies. The use of options has reduced the variability of returns at the expense of decreased average returns.

7.3 Summary of Results

The marketing simulations in the previous sections have provided a wide range of results which should be assessed by investors before incorporating the features from any one of the strategies. Some descriptive statistics showed improvement with the use of options while others showed disadvantages. A key result was the cost of the put options as represented by reductions in the mean returns of 16.06, 15.69, and 15.57 dollars per head with cash marketing, Alberta contracting, and US contracting respectively when options were included. The data in Table 15 summarizes the statistics which were generated by the simulations.

The mean and standard deviation statistics for the NF-MA contracting simulation as described in Chapter 5 were calculated for the time period from 1987 to 1993. These results are shown in Table 16 and Figure 31 to provide an additional benchmark for comparing options strategies.

Table 15. Results Summary

Strategy	Min	Max	Mean	St. Dev	RMSE	<-*$80	< -$40	>$40
Cash Marketing	-138.59	124.63	-2.32	61.33	59.27	8	18	15
Cash Marketing With options	-143.32	[illegible]5.30	-18.38	57.47	52.64	12	23	11
Alberta Contracting	-114.66	66.36	1.05	43.39	47.76	3	15	11
Alberta Contracting With Options	-127.5[illegible]	62.[illegible]	-14.64	41.81	35.64	6	20	4
US Contracting	-130.81	106.[illegible]5	11.74	49.56	62.36	5	13	41
US Contracting With Options	-117.51	86.7[illegible]	-3.83	43.98	48.70	6	16	8
NF-MA	-20.1[illegible]	10[illegible]	21.94	35.14	53.43	0	0	15

The results indicate that selective Alberta contracting along with routine put options have reduced the cash marketing risk levels to the greatest degree when compared to the strategies other than the NF-MA. With only 3 pens returning less than -80 dollars per head, the probability of the 'big wreck' is greatly reduced from the cash marking case and slightly reduced from the US contracting case. However, the probability of receiving returns greater than 40 dollars per head has also been reduced as only 11of 78 pens achieved higher returns. The relatively low mean return of -14.64 dollars per head is also a negative result of the strategy. Although the Alberta contracting with options provided good results, the results were generally inferior to the NF-MA strategy. The NF-MA strategy provided the highest return, lowest standard deviation and fewest negative return pens.

Using the RMSE criterion for risk reduction, this selective contract pricing and options strategy is the best of the simulated options strategies. The RMSE of 35.64 is 25 percent lower than the selective US contracting and options. The statistic is 40 percent lower than in the cash marketing case and 33 percent lower than the NF-MA strategy.

One of the more attractive marketing alternatives for cattle feeders is the selective Alberta contract pricing strategy. This alternative provides a modest positive return of 1.05 dollars per head which is comparable to the cash marketing return of -2.32 dollars. It is important to recognize that this average return is dependent on the ability of the cattle feeder to obtain the average monthly basis levels for the cattle contracts. Since there have been relatively few contracts of this nature over the period of the study and because the industry stakeholders are reluctant to provide actual basis information, this case study relies on hear-say and isolated producer reports of basis transactions. However, through the planning of cattle deliveries well before the cattle are purchased, reputable cattle feeders should not have difficulty negotiating basis levels which are reasonably close to the levels used in these simulations.

When comparing the use of options in addition to the primary cash and contracting strategies, it is apparent that put options have not reduced the risk of large losses to any great extent. In all three cases, the number of pens with returns of less than -40 dollars per head was increased from the respective base strategy. The number of pens with returns less than -80 dollars per head was also increased from the base marketing alternatives.

With all three primary strategies, the both the minimum and maximum observed returns were lowered with the inclusion of options. As well, all three primary strategies exhibited reductions in the mean return levels. Using the minimum, maximum and return range statistics it is apparent that the inclusion of put options is not a preferred marketing strategy. Although mean returns and variability of returns are lower when options are used, it is uncertain whether the risk-return trade-offs from using options are worthwhile. To facilitate an analysis of the risk return trade-offs from a financial market perspective, the average annual return statistics were calculated for each alternative. The returns which are shown in Table 16 are later compared in mean-variance framework in Figure 31.

Table 16. Annual Return Summary

Strategy	Mean	St. Dev	RMSE
Cash Marketing	11.65	24.88	28.08
Cash Marketing With options	3.71	21.68	21.38
Alberta Contracting	7.68	11.36	16.03
Alberta Contracting With Options	2.67	10.52	12.04
US Contracting	14.91	15.02	24.59
US Contracting With Options	8.70	12.80	18.47
NF-MA (from Chapter 5)	16.30	10.69	23.27

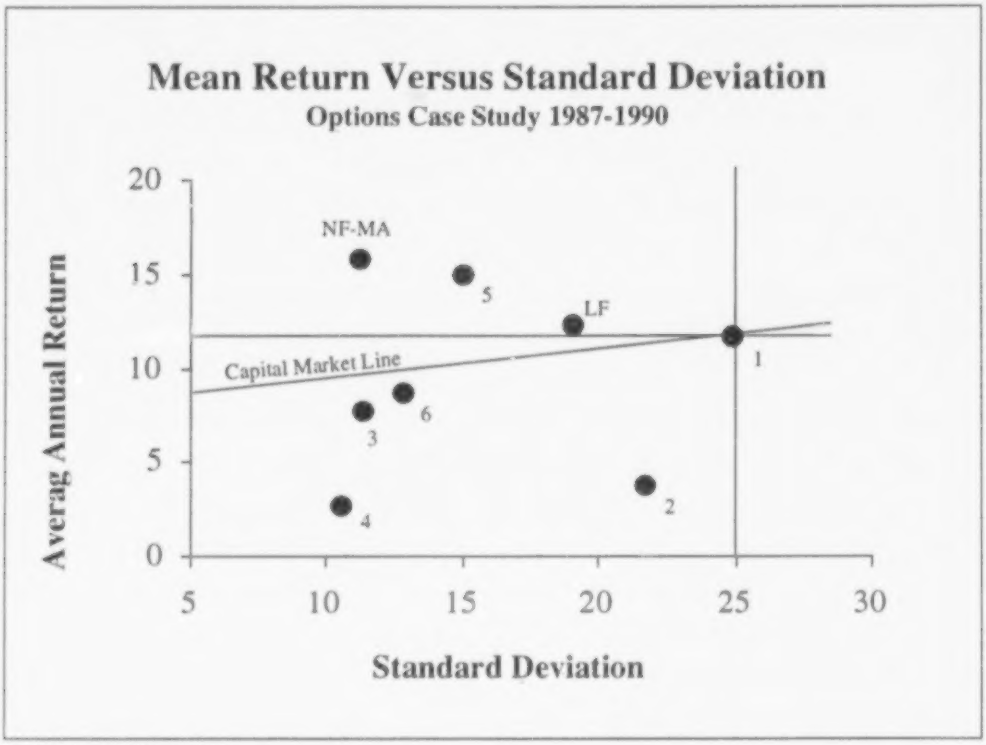
The annual return statistics in Table 16 show that, of the 3 primary strategies simulated in this chapter, US contracting as the highest return strategy with cash marketing only slightly lower. All of the strategies using options have returns that are lower than the respective base strategies. When compared to the NF-MA strategy, all of the other strategies provided lower returns, however, the Alberta contracting with options provided a slightly lower standard deviation of returns.

The plot of annual returns and standard deviation of returns in Figure 31 shows all of the strategies in relation to the original Alberta cash marketing strategy. The figure is divided into four quadrants with the cash marketing alternative at the center. Using the mean-variance efficiency criterion and an assumption of risk averse investor behavior, marketing alternatives that are located in the upper left quadrant are preferred to cash marketing while strategies located in the lower right quadrant are less preferred or dominated by the cash marketing alternative. Alternatives located in the lower left and upper right quadrants have the chance of being preferred over the cash marketing alternative by individual investors depending on investor risk preferences.

The capital market line is also included as an evaluation criterion. Alternatives lying below the line will be less preferred by risk averse investors in comparison to the risk return trade-off present in financial markets.

The results as plotted in Figure 31 indicate that the US contracting (5) and the NF-MA strategies were the only marketing strategies to provide a superior risk return trade-off over the cash marketing alternative. As well, the cash marketing strategy did not dominate any one of the other marketing alternatives. These results hold for both the E-V criterion and the capital market line criterion. The other strategies may or may not be preferred by certain investors depending on individual risk preferences.

Figure 31. Risk And Return Comparison



Strategies: (Figure 31)
1. Cash Marketing
2. Cash Marketing with put options
3. Alberta Contracting
4. Alberta Contracting with put options
5. US Contracting
6. US Contracting with put options
LF. Long Futures Position (Discussed later in section 7.4.5)
NF-MA. US basis contracting with selective feeding and selective pricing (from Chapter 5).

To evaluate the put options, the figure can be divided into four quadrants using any one of the three base marketing alternatives for comparison. The alternative to the upper left of the base alternative will be preferred by risk averse investors using the E-V criterion. As shown in Figure 31, the options alternatives with numbers 2,4 and 6 all lye to the south west of their respective base simulations which are shown by numbers 1,3 and 5. Thus, the inclusion of options may not be preferred by all risk averse investors. This conclusion holds using the capital market line criterion as well. These results are consistent with a mean-variance return comparison using RMSE rather than standard deviation as a variance measure. A plot of the mean versus RMSE statistics is located in Figure 41 in Appendix B.

In this analysis, the US contracting simulations, NF-MA and 40 dollar target pricing, were shown to be the dominant marketing strategies. One difference in results between Alberta contracting and US contracting is due to the increased weight gain in the US cattle. Given the generally lower barley prices in the later years of the simulations (Figure 2) these costs may improve the comparable US results since finishing weights were held constant over the time period of the simulation. In reality, the Alberta finishing weights are likely to increase with lower production costs, thus, increased average returns are likely. The US cattle may also experience increased weight gains, however, the US weight gains are limited by the contract weight specifications as described in Chapter 4. Cattle with weights higher than those specified will receive larger carcass quality discounts.

Another reason for the difference in returns between Alberta and US contracting is the actual level of basis used in the simulations. It is possible that producers can obtain superior Alberta basis levels than those used in this simulation. Thus, in reality, the US contracting strategy may not be as dominant as Figure 31 shows. However, the negative results from the use of put options is consistent for both US and domestic feeding periods.

Since routine use of put options has not been overly successful over this time period, the obvious question becomes: why not? The return decomposition discussion in the following section will attempt to shed some light on this question.

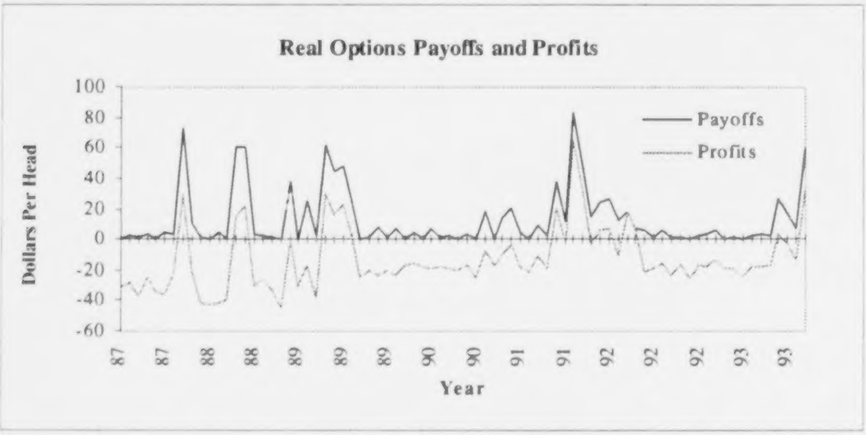
7.4 Decomposition of Returns

This section attempts to answer the question: why have put options not performed well in limiting the potential for large cattle feeding losses in Alberta? As well, this section attempts to isolate the relative magnitude of the apparent return influencing factors which include; initial return forecasts, changes in the basis levels, changes in the futures market price and changes in the Canada - US exchange rate. Previous research has shown that the relationship between basis, cattle prices and the Canadian dollar are not linear (Koontz and Trapp, 1995), thus, the various components of return changes are not additive. It should also be noted that this analysis does not conform to the recent methodology (Unterschultz, 1993), thus, the results are not robust and should not be taken too far. However, this case study will conduct a simple additive decomposition of the returns to provide an approximation of the magnitude of the relative price change effects that occurred between 1987 and 1993 in dollars per head terms. The first step in the return decomposition is an investigation of the observed put option profits.

7.4.1 Routine Put Option Trading

One step in determining the effectiveness of options is to examine the payoff and profits from the option trading strategy over the time period of the study. Payoffs are defined in this study as the change in quoted option value from the day the cattle were purchased until the day they were sold. The profits are the option payoffs less the premium paid, or option value, on the first feeding day. The Canadian dollar value per head profits and payoffs are shown in Figure 32.

Figure 32. Nominal Option Payoffs and Profits



This strategy provides positive profits in only 12 of 78 pens. The mean profit level is -13.52 dollars per head while the maximum and minimum returns are -44.79 and 64.56 dollars per head respectively. The effective option cost or the difference between the profit and payoff lines in Figure 32 has mean level of 25.86 with maximum and minimum premium levels at 45.91 and 14.93 dollars per head. The option returns are shown in Figure 33.

Figure 33. Real Put Option Returns

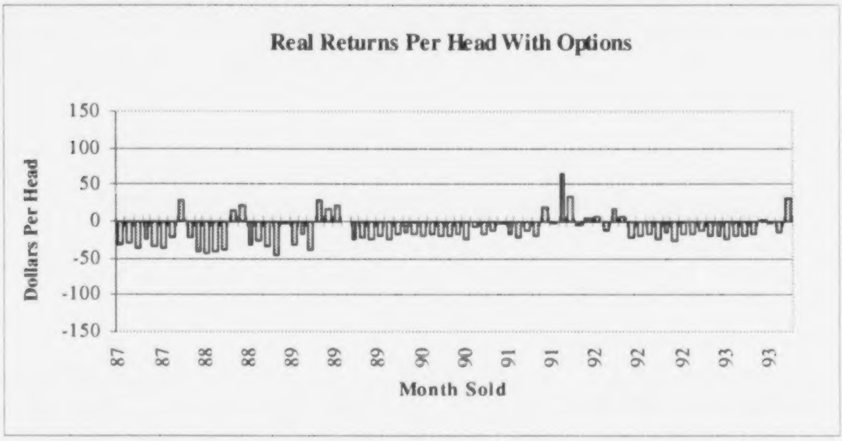


Figure 33 shows the net results from the options trading in a bar graph with the same scale as the previous cattle return figures. From this figure it is apparent that options did not have large profits when they were needed the most by Alberta cattle feeders. During 1991, when there were large cash market cattle feeding losses, there was only one pen that would have received positive option returns of over 50 dollars per head.

Figure 34. Frequency of Options Profits

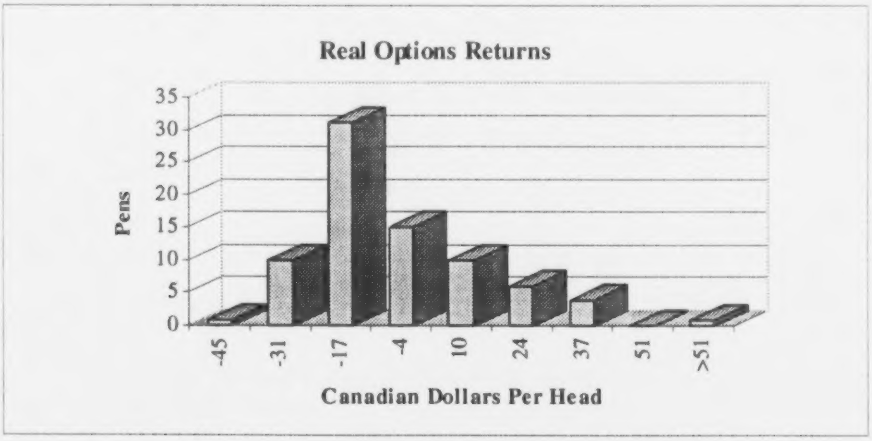


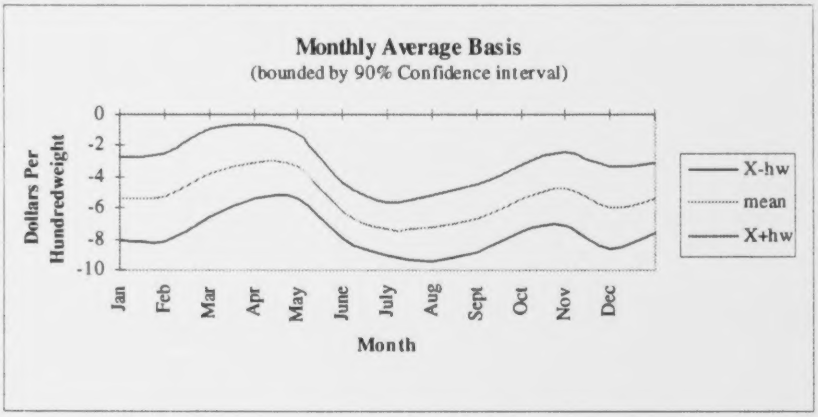
Figure 34 shows the distribution of real profits from the options trading strategy over the study time period. The figure shows that the most likely options profits will be in the -17 dollars per head range with the probability of large profits being quite small. An investor would expect the long run profits from routine put long option trading to be negative because of the loss of time value in the options. However, one would also expect to receive large positive profits from the option in periods of large cash market losses; this has not been the case. The following section begins the investigation of this negative result with an examination of the basis activity over the study time period.

7.4.2 Basis Changes

The monthly average basis levels were calculated for Alberta slaughter steers over the years from 1980 to 1993. These average basis levels along with their relative variability expressed as a 90 percent confidence interval are shown in Figure 35. The figure shows patterns of seasonality with relatively narrow basis levels in March, April and May and with relatively large or wide average basis levels in the summer months.

Although the average basis is a relatively wide -7.4 dollars per hundredweight in July, the variability of the basis is very low in comparison to the other months. With a standard deviation of over 4.82 dollars per hundredweight, we can be 90% confident that a mean basis level between -5.6 and -9.1 dollars per hundredweight will occur. In the month of February, we can be 90 percent confident that a basis level of between -8.2 and -3.1 will occur with a mean level of -5.3 dollars per hundredweight. The relatively narrow basis level in the spring months is likely due to historically tight cattle supplies during the period as yearling supplies dwindle and the fall calves are only starting to come onto the market.

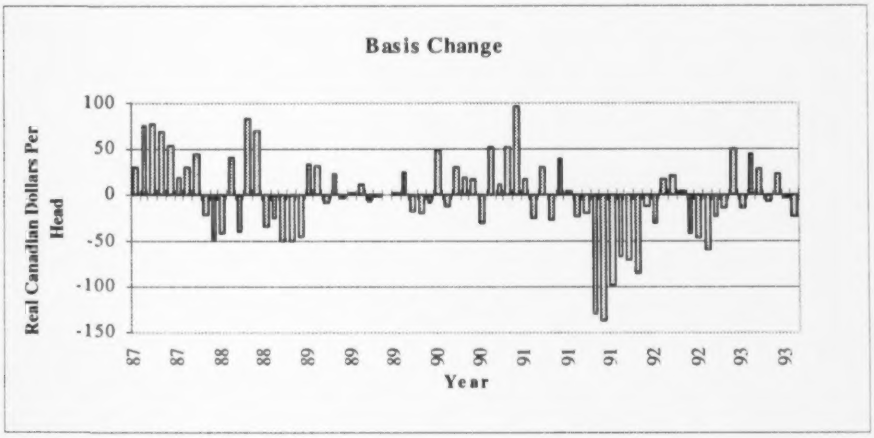
Figure 35. Average Monthly Alberta Basis ($C)



Observing the reported confidence intervals in Figure 35 is dependent upon a constant industry structure which may not be the case today. It has been hypothesized by some cattle feeders that with the current expansion in the Alberta packing industry, the basis will actually become narrower and more stable. However, this hypothesis cannot be tested at this time.

As shown in Figure 35, basis changes can be of a large magnitude when considered on a dollars per head scale. Over the time period of this case study, the maximum adverse basis change from the respective monthly mean level was 136.29 dollars per head. A maximum positive basis change of 96.28 dollars per head occurred in early 1991. For the time period of this case study, 1987 to 1993, the mean changes in observed basis level as compared to the long term average benchmark was - 1.10 dollars per head or -0.091 cents per pound. Thus the basis experienced by the simulated pens of cattle was slightly less than the monthly average for the time period from 1980 to 1993.

Figure 36. Per Head Basis Changes Over the 119 Day Feeding Period



During the large cash market loss period in 1991, the basis widened to its maximum historical levels. This basis widening played an important part in the some of the large cash market losses. Discussions with cattle feeders suggests that the basis performance during this period was influenced by cattle feeders attempting to maximize returns from cattle feeding and the generous NTSP program. The NTSP payouts were 33.68, 98.09, 131.06, 137.53, 189.53, 132.86 and 132.86 dollars per head from July to December 1991inclusive (Munro,1993). The relatively large payouts indicate there may have been an opportunity for cattle market and support program manipulation by industry participants.

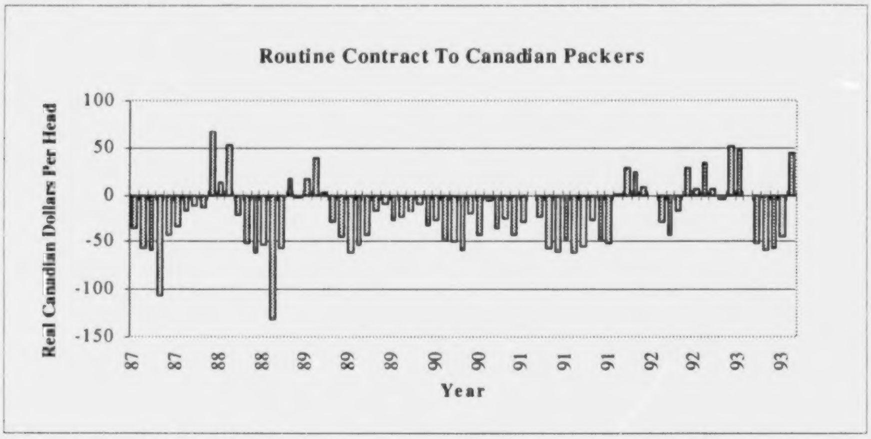
Although the basis changes in 1991 appear to be abnormal, there is no rule which says this type of basis movement cannot happen again in the future. The following section looks at the negative returns by asking whether or not the cattle should have been bought in the first place.

7.4.3 Initial Forecast of Returns

By simulating Alberta cattle contracting using basis contracts that are priced on the first day of the feeding period using the CME futures price, the effects of basis changes can be examined in relation to the start of the feeding period. The following simulation uses the average monthly basis for each pen of cattle as the known ending basis level. In reality obtaining this basis level may require the cattle feeder to negotiate a basis contract several months prior to the cattle actually being placed in the feedlot. However, this is not an unreasonable basis control strategy.

The strategy involves locking in the Alberta basis level and pricing the cattle on the first feeding day and then shipping the cattle to an Alberta packer after the required 119 day feeding period. Using this process a simple forecast of returns is made. The routine contract returns are shown in Figure 37.

Figure 37. Routine Contract Returns



The results in Figure 37 show that in most cases, the pens of cattle were placed in the feedlot at a forecasted loss. Only 5 pens were placed with forecast returns of greater than 40 dollars per head while 30 pens were placed with returns of less than -40 dollars per head. Two pens were placed with projected returns of less than -80 dollars per head. The minimum and maximum expected returns were -130.59 and 66.36 while the mean expected return was -22.62 dollars per head.

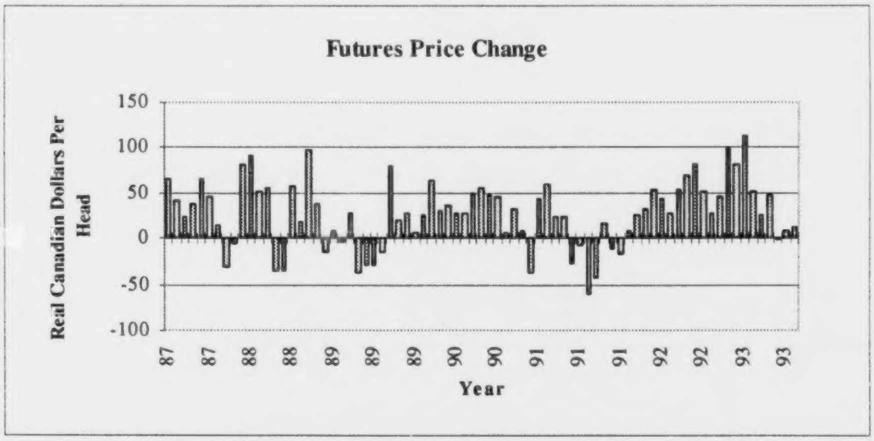
In examining the large cash market loss period in 1991, it is apparent that the losing pens were generally placed with projected losses in the 50 dollars per head range. The use of a feed versus no-feed rule as in the NF-MA strategy would have eliminated these large cash market losses, however, with strict adherence to the rule, the feedlot would have been empty for seven consecutive months. Thus, the feed versus no-feed rule as used in the NF-MA simulations may not be practical in all situations. The next section of this chapter examines the magnitude of return changes due to changes in the CME futures market prices.

7.4.4 Futures Price Changes

Changes in futures contract price levels have a direct effect on the payoffs from options since the put option is the right to take a short position in the futures contract. For the option to have an increase in value during the feeding period there normally must be a decrease in the underlying futures contract. Figure 38 shows the magnitude of the futures price changes in terms of real Canadian dollars per head.

The futures price change is also useful in explaining the ending cash market prices since by definition, the Canadian cash market price is the futures price plus the basis level. If the basis is predicted with a high degree of confidence, the futures price changes will explain a large portion of the cash market price change.

Figure 38. Futures Price Changes



From Figure 38 it is apparent that the futures prices have increased during the feeding period for most pens of cattle over the time period. However, in the large cash market loss period of 1991, the futures price changes were generally negative or near zero. The average change in value with changes in futures prices was 27.20 dollars per head with one favorable price change of 111.73 dollars per head. For one pen in 1991, the futures price reached a minimum return level of -61.24 dollars per head. This price change is consistent with the maximum net option return of 64.56

dollars per head as shown in Figure 32. In this case, an increase in market volatility likely caused a relative increase in the remaining time value of the put option when the option was sold, thus the option return was actually higher than the futures market change.

The average futures price change was equal to a per head return change of 27.21 dollars while the maximum change was 111.73 dollars. At first glance, this result seems to contradict the market efficiency arguments as presented in Chapter 2. However, these changes in return do not consider the opportunity cost of capital and risk premium required by the long futures contract position holder.

To investigate the return opportunities from holding long futures positions, the real average annual return and standard deviation statistics were calculated. The results are shown by point LF in Figure 31. By taking the corresponding long position to this simulation's routine short futures positions as represented by the routine contracts, an investor would have received 12.39 percent return with a standard deviation of 17.04. Using the E-V criterion and the capital market line criterion, this position dominates the cash marketing case but is dominated by the US contracting strategy. The long futures returns are approximately the same as the cash cattle returns but with a smaller standard deviation or risk level. However, the standard deviation statistic does not necessarily capture risk perceptions. Investors may perceive commodity futures or live cattle futures to be particularly risky, thus, the futures may require a better mean-variance trade-off to attract investors.

When considering the futures market bias we ask the question: if the market is biased down at the start of the feeding period, why doesn't everybody go long the futures and make an easy profit? The simple answer to this question is that routinely going long the futures contract is also risky and the average returns do not appear to be that lucrative with respect to cattle investments. Tax considerations may also influence the willingness of investors to feed cattle rather than taking a long futures position or buying other financial assets.

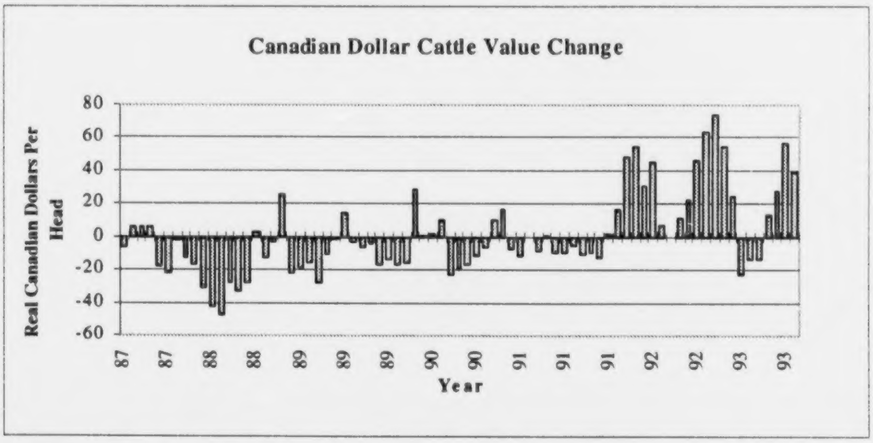
Given that in most cases, the futures market prices have risen, it is logical that most option values would have decreased over the feeding period. Thus, routine use of put options will likely have little value to producers. The following section examines the exchange rate effects on the cattle feeding returns and negative pen results

7.4.5. Canadian Dollar Value Changes

Because the Alberta cattle market is directly linked to the US market through both cattle and beef exports, exchange rate changes will affect net returns in Alberta. In recent times of rapid exchange rate changes, it has often appeared that the Alberta price changed in direct proportion to the exchange rate changes. Although this idea may be true, the long run exchange rate changes are linked with relative inflation and to changes in transportation and beef processing costs. These and other factors combine to create a non-additive relationship between futures price changes, basis changes and exchange rate changes. However, for the purposes of this case study it is important to recognize the approximate magnitude of an exchange rate change in terms of dollars per head.

This section asks the question: what happens to the returns when the cash market value of the animal at the end of the feeding period is subjected to a change in price proportionate to the change in exchange rate from the beginning of the feeding period. For this analysis, per head returns were initially calculated in nominal Canadian dollar amounts and then converted into a base US dollar value using the exchange rate at the end of the feeding period. The base returns were then converted back into Canadian values using the beginning exchange rate. The difference between the returns are shown in Figure 39.

Figure 39. Approximate Canadian Value Return Change



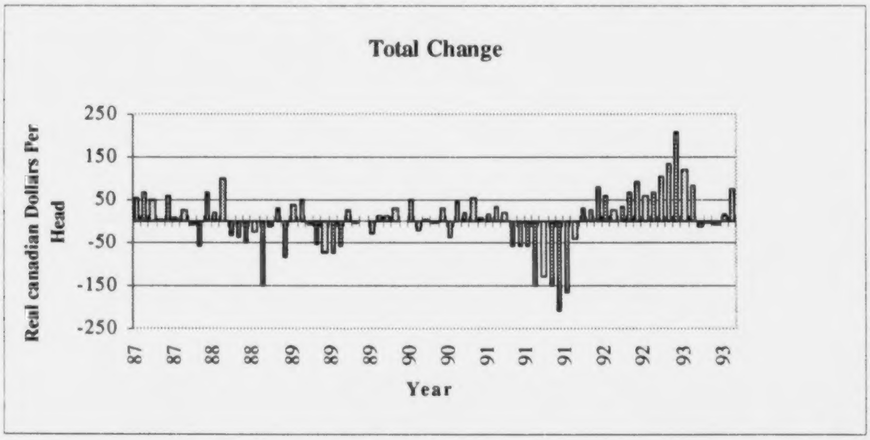
The results of the calculations show minimum and maximum effects equal to -47.16 and 73.55 dollars per head. The big cash market loss period of 1991experienced adverse value changes in the 10 to 15 dollar per head range. Large adverse value changes in the magnitude of 50 dollars per head occurred in 1988.

Although the exchange rate changes are transmitted and multiplied through all sectors of the industry, there can be no question that exchange rate changes are important. The questions then become: how important are they and how much can one justify paying for exchange rate change protection? With only 11 pens having averse value moves greater than 20 dollars per head and 15 pens with favorable value changes greater than 20 dollars per head, routinely hedging the exchange rate would likely not have been a profitable strategy over this time period. The next section sums up the previously discussed per head return effects to see how close they come to the original cash market returns.

7.4.6. Total Effects

To this point, this case study has examined the approximate changes in returns due to basis changes, futures price changes, and exchange rate changes. This section adds up the previously calculated effects to generate an approximate total return effect. The results of this summation are shown in Figure 40.

Figure 40. Total Change



The results of the summation show a pattern of returns which is very similar to the initial cash market returns shown at the beginning of this chapter in Figure 25. However, due to the non-additive nature of the individual components, the magnitude of the effects has been increased with respect to the very large and very small returns. Simulated cash market returns in 1991 did not reach the -150 dollar per head level as shown by the sum of effects.

7.4.7. Summary of Return Changes

This section summarizes the results of the approximate return changes due to changes in futures prices, basis levels and exchange rates. The results indicated that the pens of cattle were placed at an average forecast loss of 22.63 dollars per head while the futures price changes have increased returns by an average of 27.21.dollars per head. These results show that there is a likely initial downward bias in the futures market prices amounting to approximately 27.21 dollars per head over the study time period. It appears as though cattle feeders have recognized this bias and have bid the price of feeder cattle up to a point where projected losses based on the futures market price are approximately 22.63 dollars per head.

The apparent futures market price bias and the large average increases in the futures prices have negative implications for the effectiveness of put options which generally require a decrease in the futures price for positive payoffs. However, there were isolated cases where the use of a put option reduced losses.

The change in basis from the average monthly basis levels resulted in maximum changes which were over double the magnitude of the adverse futures price changes. The largest futures price change from the start to the end of the feeding period was 61.42 dollars per head while the largest basis change from the monthly average was 136.29 dollars per head. This comparison is an indication of the relative importance of basis risk reduction compared to futures price risk reduction strategies over the time period of this study.

Since basis changes have resulted in relatively large adverse return changes, it is apparent that basis control strategies may have a relatively high value to compared to futures price risk reduction strategies such as put options. However, it is important to recognize that the many of the averse basis moves in this time period may have been due to the influence of Government programs including the NTSP.

The approximate changes in returns from exchange rate changes are also important with negative and positive changes from the start of the feeding period at -47.16 and 73.55 dollars per head. However, of all of the return effects, the exchange rate changes are of the smallest magnitude over the period of this case study. In periods of generally rising Canadian dollar values, exchange rate risk reduction may have value to cattle feeders. Because of the interactions between exchange rates and basis levels, the results from this study do not imply a direct value to locking in the exchange rate with contracts or option strategies.

The results from this return decomposition and the previous cattle feeding simulations are further discussed in the following case study conclusions section.

7.5 Case Study Conclusions

The results in section 7.3 have shown the NF-MA strategy to be the best of the simulated marketing strategies in terms of risk return trade-off given the fixed nature of the computer model's production system. One result to come out of section 7.3 was that the inclusion of put options with the base Alberta contracting, cash marketing and US contracting strategies did not produce a preferred marketing alternative using the risk efficiency criteria considered here.

Of the three primary strategies, selective Alberta contract pricing has provided the best risk reducing results in terms of minimum returns, RMSE and standard deviation statistics. Although this strategy has provided the best risk reduction, it also provides the most limitations to high returns with the mean returns somewhat lower than the cash marketing and US contracting alternatives. The Alberta contracting pricing appears to be an acceptable alternative, however, the results are based on the assumption that basis levels can be locked in at the updated average levels. Communication with industry stakeholders confirm that this is not an unreasonable assumption. The risk reducing power of this strategy does not depend on the actual level of the basis, but rather the stability of the basis from the day the cattle are purchased.

As with the US contracting strategy, the Alberta contract pricing strategy relies on a simplistic pricing rule with the 40 dollar per head target. Alternative selective pricing strategies such as the one used in the NF-MA strategy may have the effect of increasing mean returns to higher levels. However, it is not appropriate to extend the Alberta contracting strategy any farther without the availability of hard basis data.

The return decomposition in section 7.4 indicates that basis changes have resulted in large return changes from average levels. Futures price changes exhibited maximum adverse value changes that were only 55 percent of the value of adverse basis moves. This analysis does not dispute the Koontz and Trapp (1995) conclusion that basis risk is more than twice as large as short run price risk. However, an alternative methodology than that used in this study is required to generate more robust results for this time period.

The decomposition analysis in 7.4 supports the view that basis risk an important part of return risk. Given that basis changes can cause large return changes, it is not a surprise that basis contracts have become popular with producers in recent years.

The main result of this case study analysis is that the routine use of put options has not been a dominant marketing strategy when compared to non-options strategies. The negative result is due to the futures market prices not changing in direct proportion to the Alberta cash market price. The lack of adequate futures price movements has resulted in options returns that do not provide a great deal of compensation to Alberta cattle feeders in times of large cash market losses.

The results of this analysis have negative implications for the success of the 'Canadianized Option' which is being proposed as a return insurance program for cattle producers. However, an objective evaluation of the options pilot program is beyond the scope of this study.

CHAPTER 8 CONCLUSION AND IMPLICATIONS

This study evaluated the risk and returns to cattle feeding in Alberta from the application of alternative marketing and pricing strategies. Feedlot finishing of 650 pound calves and 800 pound yearlings was modeled over the years from 1980 to 1993. The results of the study were based on the domestic and US marketing of live cattle using traditional cash marketing, futures contracts, put options, and forward production contracting systems. Use of the Western Domestic Feed Barley contract was also simulated. The general conclusions arising from these simulations are presented in the first part of this chapter while the second section applies the conclusions to the Alberta cattle feeding industry and suggests directions for future research initiatives.

8.1 Conclusions

The primary conclusion of this study is: that in this post NTSP time period, there are risk management strategies available to Alberta cattle producers which have the potential to limit the severity and frequency of cattle feeding losses while maintaining a reasonably stable and competitive rate of return. This conclusion is based on the success of the routine contracting and NF-MA contracting strategies which limit basis risk and have allowed for the use of flexible cattle pricing methods.

This study has found changes in live cattle basis, futures prices, exchange rates and input prices to be important contributors to return risk. The simulations in this study have suggested that basis risk was an important source of return risk in Alberta cattle finishing over the time period of this study. This conclusion is highlighted by a large 136. 29 dollar per head difference between the observed and historical average basis level in 1991. The importance of basis risk was also evident with the change in distribution of returns from cash marketing when Alberta and US routine contracting strategies were simulated. It was also recognized that the large adverse basis changes may be due, at least in part, to the existence of Government programs. Thus, in the post NTSP time period, the relative importance of changes in the live cattle futures market prices and input prices may increase.

The analysis in Chapter 6 concluded that the sensitivity of returns to barley price changes was relatively small in relation to feeder and fat cattle price changes. Use of the WDFB futures did not decrease within feeding period return risk. However, this analysis was restricted by the short period of time in which the contract has operated. Thus, the WDFB cannot be disregarded as an instrument for minimizing the effects of adverse barley price movements both within and in advance of the feeding period.

This study found futures price changes to be an important factor in return risk as shown by the routine hedging results. Futures contract hedging was found to reduce risk while reducing returns. The potential for large margin calls with the use of futures contracts was also identified as a likely problem for some producers. Maximum potential margin requirements of 234.59 dollars per head were observed. With the relatively the low mean return and potential for large margin calls, it was concluded that routine hedging with futures contracts is likely not an optimal strategy for most Alberta producers. Contracting simulations which removed the basis risk and potential margin calls provided superior results to routine hedging .

Cattle contracting in the form of routine contracts and selectively priced contracts have reduced the probability of large negative returns while increasing the probability of higher returns as shown by the frequency distributions in Figures 19 through 23. As well, simulated contracting to both US and domestic plants has improved the performance of feeder cattle investments from a financial market perspective. For the 1987 to 1993 time period, US contracting was a dominant strategy using both the E-V and capital market line criteria. However, the dominance of the US contracting strategy may be overstated due to the fixed nature of this study's production system.

Contracting to Alberta plants has improved the distribution of returns and has reduced return variability while maintaining levels of return similar to the cash marketing case. However, these results are also subject to individual cattle feeder interpretation since there is very little publicly available contract information. True mean returns may be above or below those simulated depending on an individual producer's ability to secure favorable basis levels from the packing plants. However, there is little doubt that the ability to lock in the basis to Alberta plants can have a positive effect on the distribution and stability of returns. This is confirmed by the lowest number of less than -80 dollar per head returns(Table 15) and the lowest standard deviation of returns (Table 16). The Alberta contracting simulations also confirmed that there may be value in not feeding cattle when projected losses are large.

The basis contracting of cattle allows producers the flexibility to use alternative pricing strategies which use fundamental and technical market information. The inclusion of the moving average decision rule in the NF-MA strategy has shown that there may be value in using technical trading signals for the pricing of cattle. The routine contracting simulation in Chapter 7 indicated that the futures market may be biased downward at the beginning of the feeding period but the simulated long futures position did not confirm this. In a financial market comparison, the long futures position exhibited rates of return similar to cash market cattle feeding with a standard deviation of returns that was greater than US contracting.

With the loss of the NTSP program, the use of put options in various forms has been suggested as a possible instrument for establishing a floor price for cattle. From the results in Chapter 7, this study cannot conclude that the routine use of put options are valuable to Alberta producers. This is due to the limited downward movements of the futures market prices in periods when Alberta cash market cattle returns were low.

In general this study has shown positive value in cattle contracting strategies that have removed the basis risk. As well, alternative pricing strategies like the NF-MA have shown to provide better risk return trade-offs than the base cash marketing strategy and other strategies.

8.2 Implications

This study has shown positive results for contracting and alternative pricing strategies, however, it important to realize that the results are quite general in nature. Given that there are many different production systems and management styles present in the Alberta cattle feeding industry, the marketing alternatives must be modified for each operation. The risk preferences of each manager will affect the choice of marketing strategy and the optimal pricing mechanisms. The results of this study are also limited by the use of weekly average price levels.

Future research into alternative marketing strategies should reflect actual transaction and production results in order to better reflect true risks and returns. Future consultations and strategic alliances with producers and industry stakeholders will be important to improving the research results and generating more detailed and optimal management systems for producers.

With the generally negative results from the put option simulations it is important that producers enter the new options pilot program with caution. Additional research into the proposed option structure and pricing mechanisms is required so that producers can make well informed decisions. As well, effective extension programs should be implemented to minimize producer uncertainty with options and other risk management strategies.

Given that basis contracts may become more prevalent in the Alberta cattle industry, research into the development and evaluation of basis and price forecasting models is also important. It is important that producers know what is, and what is not a good basis level given the fundamental and technical information available at any point in time.

The bottom line of this study is that there are market based strategies which can reduce risks to comparable market levels without the use of government programs like the former NTSP.

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APPENDIX A. Production Parameters

This section contains tables of the production and marketing parameters that were used in the simulation models. All of the tables were referred to in the main text.

Table 17 shows the amount of daily feed use for the different weight ranges of cattle considered in this study. The rations for the various weights of cattle are based upon feed usage at 5 percent above the minimum nutrient requirements described in the Alberta Agriculture ration balancing program. The feed requirements can be considered conservative, thus, different management practices and different cattle types will result in different cattle performance levels.

Table 17. Balanced Rations (lbs per head per day)

	weight	silage	barley	supp.	total
Ph 1. background ADG=1.5	500	17.1	6.6	0.5	23.7
	550	17.9	7.2	0.5	25.1
	600	18.5	7.7	0.5	26.2
	650	19.1	8.3	0.5	27.4
	700	19.5	8.8	0.5	28.3
	750	19.8	9.4	0.5	29.2
	800	20.3	9.9	0.5	30.2
	900	20.8	10.5	0.5	31.0
Ph 2. Warm-up ADG=2.5	700	14.3	14.3	0.75	28.6
	750	14.9	14.9	0.75	29.8
	800	15.5	15.5	0.75	31.0
	850	16.2	16.2	0.75	32.4
	900	16.9	16.9	0.75	33.8
Ph 3. Finishing ADG=3.5	700	4.8	19.4	1	24.2
	750	5.2	20.8	1	26.0
	800	5.5	22.2	1	27.7
	850	5.9	23.2	1	29.1
	900	6.3	24.2	1	30.5
	950	6.5	25.4	1	31.9
	1000	6.7	26.5	1	33.2
	1050	7.0	27.4	1	34.4
	1100	7.3	28.3	1	35.6
	1150	7.5	29.3	1	36.8
	1200	7.7	30.3	1	38.0
	1250	7.9	31.4	1	39.3

Table 18 contains the production costs that were used in the model. In some cases, 1993 price levels were used as a base for time series development using the appropriate indices. The table identifies the indices used and base price levels.

Table 18. Production Costs

Input	Adjusted by:	1993 price level
Barley	weekly time series	Red Deer Street price
Silage	weekly time series	calculated as per section 4.7
32% Supp.	PF index	0.1093 $/lb
Bly processing	PF index	$10/tonne
Bedding	FIP index	$0.06/hd/day
Yardage	FIP index	$0.18/hd/day
truck in	Sup & Serv index	$.75/cwt
commission in	Sup & Serv index	$4.00/hd
Processing	Vet index	$9.50/hd
Yrlg Medicine	Vet index	$6.50/head
Calf Medicine	Vet index	$22.50/head
Truck to Colo.	Sup & Serv index	$5.00/cwt
Truck to Wash	Sup & Serv index	$3.25/cwt
Truck to S.Ab.	Sup & Serv index	$1.50/cwt
Grading-Colo	CPI	$2.00/cwt
Grading-WASH.	CPI	$2.00/cwt
Grading - Ab.	Sup & Serv index	$0.00
Ab. selling costs	Sup & Serv index	$3.00/hd
U.S. selling costs	Sup & Serv index	$4.50/hd
Calf Death Loss	constant	2% / lot
Yrlg Death Loss	constant	1% / lot

Table 19 contains the US contract basis levels as supplied by the contracting agents. The table shows the range of basis levels as the futures contract approaches maturity.

Table 19. Basis levels (DTM = days to futures contract maturity)

	Monfort's		IBP			
	Opening	90 DTM	Opening	180 DTM	120 DTM	60 DTM
Jan	-0.5	-1	-1	-1.5	-2.0	-2.5
Feb	-0.5	-1	-1	-1.5	-2.0	-2.5
Mar	-0.5	-1	-1	-1.5	-2.0	-2.5
Apr	-0.5	-1	-1	-1.5	-2.0	-2.5
May	0	-0.5	+0.5	0	-.5	-1
Jun	-0.5	-1	-0.5	-1.0	-1.5	-2.0
Jly	-0.5	-1	-1	-1.5	-2.0	-2.50
Aug	-0.5	-1	-2	-2.50	-3.0	-3.50
Sep	-0.5	-1	-2	-2.50	-3.0	-3.50
Oct	-0.5	-1	-1.5	-2.0	-2.5	-3
Nov	-0.5	-1	-1	-1.5	-2.0	-2.5
Dec	-0.5	-1	-1	-1.5	-2.0	-2.5

APPENDIX B. Simulation Results

The results in Table 20 are from the base cash marketing simulation. The results are calculated by month with the mean level immediately above the standard deviation statistic.

Table 20. Cash Market Returns in Dollars per Head (Mean/Standard Deviation)

	Without Int. ($/Hd)		With Interest ($/hd)		Ave. Ann. Ret.	
	Yearlings	Calves	Yearlings	Calves	Yearlings	Calves
Jan	29.43	46.66	-2.06	1.21	13.03	12.80
	64.32	68.62	67.82	76.72	26.20	18.07
Feb	40.71	54.90	10.07	10.39	17.35	14.80
	43.87	40.61	51.58	50.92	18.50	12.11
Mar	57.20	75.69	26.31	31.87	24.83	19.77
	56.33	40.55	64.23	45.59	23.75	11.37
Apr	76.33	98.37	45.20	54.71	31.52	25.91
	70.04	68.14	71.72	68.24	29.55	18.43
May	63.95	94.20	30.87	50.63	29.13	25.12
	101.43	92.10	103.80	91.78	49.55	25.16
June	20.39	63.06	-12.26	20.24	10.48	17.10
	83.84	81.06	85.00	80.20	32.35	22.25
July	15.23	22.83	-16.78	-23.43	6.71	6.89
	68.84	64.29	66.16	68.53	24.91	16.14
Aug	29.55	34.32	-1.69	-11.31	11.47	9.19
	64.89	60.87	62.68	62.15	22.78	15.83
Sept	21.79	42.62	-9.40	-2.23	8.79	11.45
	73.64	71.73	71.73	74.10	25.83	18.85
Oct	40.46	68.04	8.97	23.63	16.77	17.61
	73.81	68.44	77.06	70.85	28.09	17.67
Nov	46.34	59.86	13.85	15.33	19.02	14.90
	79.00	76.83	80.65	78.24	30.96	18.02
Dec	24.80	34.60	-7.07	-9.75	11.69	8.99
	74.82	83.35	78.09	86.46	29.25	19.64
Ave	38.59	57.40	6.90	12.89	16.63	15.23
	72.59	70.98	74.34	73.63	29.52	18.46

The results shown in Table 21 are the monthly average results from selective contracting cattle to the US plants. The number pens that were contracted in each year is show in Table 23.

Table 21. Selective Contracting(40 Dollar Per Head Target) Results

	Without Interest		With Interest		Ave. Ann. Return	
	Yrlgs	Calves	Yrlgs	Calves	Yrlgs	Calves
Jan	32.45	51.97	-8.31	-2.9	11.7	12.89
	72.97	87.17	76.64	90.66	27.9	22.36
Feb	52.46	83.67	12.22	29.67	18.14	21.94
	59.71	63.9	53.71	72.48	22.26	16.6
Mar	98	107.75	58.6	54.71	36.5	28.1
	44.06	39.4	37.68	35.57	16.59	11.06
Apr	90.22	122.69	50.46	70.26	32.95	32.1
	39.96	65.52	32.27	54.09	14.37	17.49
May	87.93	132.55	48.08	80.5	32.24	35.16
	41.77	75.68	37.58	64.57	15.68	20.37
Jun	77.24	106.22	35	54.24	27.33	27.68
	53.07	72.49	52.5	62.02	21	19.36
Jly	41.82	86.18	0.04	34.89	15.19	22.38
	67.32	59.87	71.71	53.7	23.64	16.03
Aug	48.59	65.86	7.61	10.74	16.05	15.57
	60.12	55.91	53.54	57.85	22.24	15.02
Sep	50.07	66.55	9.86	12.03	16.86	15.99
	53.5	54.26	52.35	58.56	20.72	15.34
Oct	46.98	74.06	7.06	20.69	15.35	18.67
	57.27	62.63	53.16	66.68	20.93	17.19
Nov	44.78	85.75	2.8	32.82	15.16	22.21
	63.32	57.01	67.53	62.28	23.83	15.92
Dec	47.53	71.13	6.16	18.23	16.41	17.47
	61.95	64	65.34	68.32	23.84	17.28
Ave	59.62	87.39	18.91	34.17	21.06	22.37
	59.02	66.08	58.29	65.87	22.22	17.87

Table 22 shows the number pens of yearlings and calves that were contracted in each year of the simulation using the 40 dollar per head target pricing rule. Also included is the average number of days that it took before the target price was achieved.

Table 22. Selective Contracts by Year

	Pens Contracted		Days after Purchase	
Year	Yearlings	Calves	Yearlings	Calves
1980	6	4	14	21
1981	7	7	13	67
1982	8	9	13	3
1983	6	11	20	15
1984	11	10	15	24
1985	12	12	0	71
1986	12	12	10	86
1987	9	12	48	87
1988	3	7	15	63
1989	1	2	7	15
1990	1	6	8	35
1991	0	1	0	24
1992	10	10	30	17
1993	7	6	20	8

Figure 41 contains the market based comparison for the yearling strategies that were simulated in the options case study in Chapter 7. The figure uses RMSE in the place of standard deviation as the risk measure. Table 24 on the following page contains the summary statistics for simulations in Chapter 5.

Figure 41. Mean and RMSE Comparison

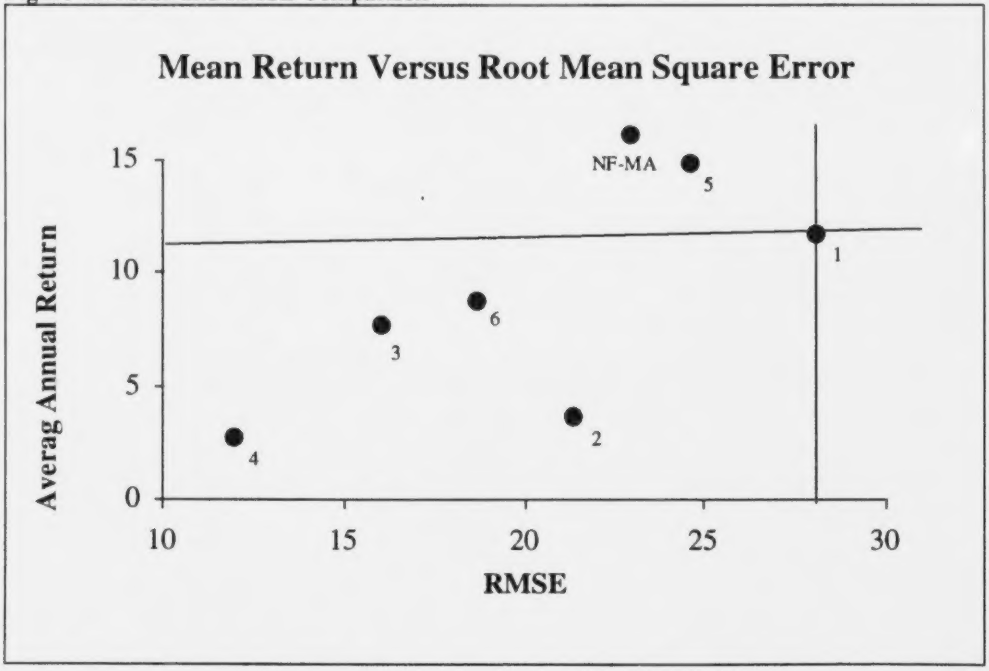

Table 23. Return Summary

		Dollars per Head			Percent Return	
		Yearlings	Calves		Yearlings	Calves
Cash Marketing	mean	6.90	12.89	mean	16.63	15.23
	st dev.	74.34	73.63	st dev	29.52	18.46
	min	-161.16	-165.62	min	-39.49	-29.54
	max	325.92	283.3	max	186.4	92.1
	>$50/hd	38	43	>50%ret	20	7
	<-50/hd	32	30	< 0 %ret	44	29
Routine Hedge	mean	-11.45	-5.42	mean	7.58	11.07
	st dev.	59.48	62.23	st dev	21.55	14.31
	min	-155.71	-183.03	min	-41.76	-25.43
	max	157.55	200.31	max	67.03	54.60
	>$50/hd	26	27	>50%ret	0	1
	<-50/hd	45	35	< 0 %ret	63	30
Routine Contract	mean	8.30	30.98	mean	13.64	16.97
	st dev.	49.00	55.87	st dev	14.07	11.30
	min	-103.60	-96.48	min	-20.04	-12.29
	max	129.70	174.89	max	65.54	68.47
	>$50/hd	31	51	>50%ret	0	0
	<-50/hd	14	10	< 0 %ret	26	10
Basis Contract	mean	21.38	40.71	mean	18.19	20.06
	st dev.	77.05	79.42	st dev	22.39	15.54
	min	-161.34	-231.81	min	-24.25	-19.28
	max	239.27	294.59	max	96.87	76.17
	>$50/hd	51	68	>50%ret	15	5
	<-50/hd	29	19	< 0 %ret	26	11
Selective Feeding	mean	16.63	17.08	mean	18.67	14.80
	st dev.	68.32	71.22	st dev	22.35	16.71
	min	-161.16	-165.62	min	-34.12	-24.05
	max	181.99	146.58	max	94.55	91.89
	>$50/hd	46	88	>50%ret		1
	<-50/hd	7	0	< 0 %ret	4	0
Selective Contact	mean	18.91	34.17	mean	16.27	17.48
40 dollar target	st dev.	58.29	65.87	st dev	18.34	13.76
	min	-161.71	-166.32	min	-39.49	-29.54
	max	129.70	174.89	max	65.54	68.47
	>$50/hd	43	56	>50%ret	0	0
	<-50/hd	25	21	< 0 %ret	31	21
Selective Contact	mean	28.75	69.17	mean	19.46	22.37
	st dev.	44.80	58.19	st dev	12.87	13.38
NFMA Rule	min	-161.34	-1.32	min	-20.16	5.69
	max	145.6	303.16	max	59.40	85.91
1980 - 1993	>$50/hd	45	85	>50%ret	1	7
	<-50/hd	7	0	< 0 %ret	5	0
Selective Contact	mean	21.94	55.55	mean	16.30	4.49
	st dev.	35.14	36.40	st dev	10.69	9.08
NF-MA Rule	min	-98.06	1.07	min	-20.16	0.43
	max	103.10	176.60	max	46.54	55.07
1987 - 1993	>$50/hd	11	40	>50%ret	0	2
	<-50/hd	0	0	< 0 %ret	0	0